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Science News x

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PRESENT STATUS OF INVESTIGATIONS CONCERNING ANTIQUITY OF MAN IN CALIFORNIA[1]

THE fact that archeologists and historians have been interested in the problem of the antiquity of man in California for the past 60 years is due in a considerable measure to the peculiarity of the problem in that region. The California area offers exceptional opportunity for a great variety of studies in archeology and anthropology, and especially for those dependent upon cur knowledge of geological processes of the present and of the period immediately preceding. The fact that the coast region of California seems to have been in almost continuous movement throughout the later geological periods means that there has been continuous erosion accompanied by continuous deposition, giving us at the same time a record of the processes of erosion and deposition and of the life of the region in this period.

It has been realized from the beginning of our studies on the Pacific coast that satisfactory conclusions regarding the antiquity of man in California can not be reached within any narrow time limits, and that no single mode of attack may be considered sufficient in itself. At the initiation of the studies conducted at the University of California four lines of investigation were laid down: (1) Tracing man back in time through an examination of the great shell mounds of the coast region, the most critical study being given to the lowest or earliest deposits. In this work opportunity was offered for going from the known culture of the uppermost layers of the mounds back to a period in which conditions may have been quite different from those governing the life of the Indians of the last centuries. (2) The thorough investigation of all available cave deposits, whether Recent or Pleistocene, with particular reference to possible human occupation. (3) A careful study of those Pleistocene and Recent land, stream, lake and marine formations in which the occurrence of human remains or relics appears possible. This comprised a study of many Pleistocene formations and the collection in them of all obtainable fossil remains. (4) A careful review of all evidence relating to the reputed occurrence of implements or human remains in the older gold-bearing gravels or other ancient deposits of a similar nature in California.

[1] Read before the National Academy of Sciences, Washington, D. C., April 29, 1924.

After practically 25 years' research on the antiquity of man in California from the point of view of the archeologist, anthropologist, paleontologist and geologist, it is clear that the problem is not only extraordinarily interesting but is exceedingly complicated. There are many evidences in caves, in alluvial and stream deposits, in the shell mounds and in asphalt deposits, indicating the occurrence of man on the Pacific Coast for a period which must in all probability be measured in terms of many thousands of years. Up to the present time all the human remains discovered are of what have been recognized as modern types. So far as has been determined they do not differ materially in their characteristics from the various races included within the group of the American Indians of to-day. The implements and other evidences of man's handiwork are also in general of modern appearance and different from the ancient types known from the Pleistocene deposits of Europe.

Up to the present time no definite evidence has been secured in California of the occurrence of human remains in a geological formation older than the present or Recent period. Although there are occurrences which have suggested the possibility of man's existence in the Pleistocene or the period immediately preceding the present, most careful investigation has not up to the present time given us definite evidence indicating that either human remains or implements produced through the work of man have been recovered from deposits antedating the present geological period.

Though the geological evidence before us does not give for the Pacific Coast of America any clear proof of man's presence in the Pleistocene, during which he is known to have been distributed widely over the Old World, this must not be interpreted to mean that the human race has not been present in that region for many thousands of years. A time measured in thousands or perhaps tens of thousands of years would naturally be required for the development of such divergence as we know among the physical types of America, and would also seem to be required for origin of the differences in culture and in language so abundantly represented among the aboriginal peoples of the western hemisphere. The geological evidences of occurrence of man in California permit our considering the possibility of his presence there for at least as long a time as seems required by the evidence of his physical and cultural differentiation on this continent.

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A RECENT DISCOVERY OF ANCIENT HUMAN REMAINS IN LOS ANGELES, CALIFORNIA[1]

INTRODUCTION

IN March, 1924, the Thomas Haverty Company, in cutting a trench preparatory to laying Section 11 of the north outfall sewer for the city of Los Angeles, encountered human remains at a depth of approximately 19 feet. Through the interest of Mr. George Hess, vice-president of the Haverty Company, the human remains were submitted to Dr. William Alanson Bryan, director of the Los Angeles Museum of History, Science and Art. The museum has appreciated greatly the courteous service rendered by the officials of the Haverty Company in the excavation of the locality where the human bones were found. Under the supervision of Dr. Bryan, and with an appropriation by the Board of Supervisors of Los Angeles County, the investigations are being continued in the vicinity of the original locality.

LOCATION AND GENERAL FEATURES OF THE REGION OF THE DISCOVERY

The locality is situated approximately one third of a mile west of the Angeles Mesa Drive and 300 yards south of the tracks of the Pacific Electric Air Line, on the Spanish land grant called Paso de la Tijera (Santa Monica Quadrangle, U. S. G. S.), between Los Angeles and Culver City. The Pleistocene asphalt deposits of Rancho La Brea lie three miles to the north and slightly to the west of this locality.

The region in which the human remains were found is a relatively flat or slightly undulating country bordered on the southwest side by the Baldwin Hills. These hills rise rather abruptly along their northeast front to a height of over 500 feet. The Baldwin Hills are presumably traversed by a fault (Inglewood Fault) extending in a north-west-southeast direction and emerging from the hills near their western border. The valley or plain area along the northeast front of the Baldwin Hills and in the immediate vicinity of the locality where the human remains were found has an elevation of 100 to 125 feet above sea level, and is drained by Ballona Creek. This stream does not possess much of a gradient and within very recent times (topographic survey 1893) marsh lands and ponds featured its course in the northern portion of the land grant Paso de la Tijera and in the southern portion of the land grant Las Cienegas. To the north of this marsh area the land surface becomes gradually higher toward the base of the Santa Monica Mountains.

[1] Read at the meeting of the National Academy of Sciences, Washington, D. C., April 29, 1924.

NATURE AND OCCURRENCE OF HUMAN REMAINS AT THE TYPE LOCALITY

At least six human individuals were found between the levels of 19 and 23 feet below the surface and within an area of not more than 12 square feet. Five individuals represented in this group were adults. A sixth individual, somewhat younger, may be a female. The structural characters of the skulls, so far as comparisons have been made, are those of modern types. The skulls do not exhibit the primitive features seen in the Neandertal man of the European Pleistocene. The remains resemble closely those of American Indians but have not been definitely determined as belonging to racial types represented by the Channel Island Indians of Southern California. There is undoubtedly resemblance between the two forms, but further comparison should be made, particularly with a larger series of modern types than that which has been available to the writer.

The osseous material was not scattered and the skeletal elements for some of the individuals at least were observed to be in normal position. Some of the human remains show considerable replacement of the bone material by mineral matter. In other specimens this replacement does not seem to be so great. A chemical analysis of the specimens has not yet been made. The occurrence of the material at a depth ranging from 19 to 23 feet and the lack of evidence of disturbance of the overlying deposits preclude the possibility of burial. The osseous material was not washed in, and its occurrence suggests rather a miring under bog or marsh conditions, presumably prior to the accumulation of the greater portion of the deposits that now overlie the human remains. A quartzite boulder, regarded as an implement by Dr. Edgar L. Hewett, and a small awl-like object were found in the sedimentary materials removed from the pit at the human locality. Data regarding their position in the section are not available. No remains of Pleistocene or of recent mammals were secured from the deposits in which the human material occurred.

The section at the type locality (Locality 1) presents a conformable sequence of deposits, consisting largely of drab- or olive-colored, unconsolidated, micaceous sands and sandy clays. A light-colored sand, eight inches thick, occurs four feet below the surface. In the entire exposure horizontal bedding is suggested only by the light-colored sand at the four foot level and by dark carbonaceous bands occurring at three lower levels. The upper and middle dark bands, at depths of 10 and 14 feet, respectively, are sharply set off in color from the materials immediately above, but grade downward in each case into drab-colored sand or sandy clay. The upper and middle carbonaceous bands are rather persistent and have been observed for nearly a mile along the line of the Haverty ditch on Section 11. Small nodules of gypsum appear below the upper margin of the second dark band. The deposits above this horizon appear to be quite gypsiferous. Numerous fresh-water molluscs were found above the second or middle dark band and scattered remains occurred below the upper margin of this horizon. Dr. A. J. Tieje, of the Los Angeles Museum, has determined the following forms:

Helisoma (Planorbella) trivolvis Say
Helisoma ammon Gould
Lymnaea solida cubensis Pfeiffer
Lymnaea (Galba) truncatula Müller
Physa cf. hypnrorum Linne
Physa sp.
Pisidium sp.

A small crustacean, referred tentatively to the genus *Porcellio,* was also found. The molluscs represent types living to-day and are regarded by Dr. Tieje as indicative of quiet waters and of swamp or marsh conditions.

The third or lowest zone of dark, carbonaceous sand occurs at a depth of approximately 18 feet and is narrower and not so well defined as the middle and upper bands. A few inches above this horizon is a thin (1 inch thick) concretionary layer, distinctly more consolidated than the surrounding sands. The bed in which the human remains were found lies below the narrow third dark band and above a clay, green or greenish-blue in color when moist and with some carbonaceous matter. Below this is a greenish micaceous sand. A considerable seepage of water occurred immediately above the green clay.

DEPOSITS IN THE VICINITY OF THE TYPE LOCALITY AND THEIR BEARING ON THE AGE OF THE BEDS CONTAINING THE HUMAN REMAINS

The section at Locality 2, situated at Mesa Drive, east of Locality 1, so far as this is exposed in the wall of the Haverty trench, does not differ noticeably from that at Locality 1.

At Locality 3 on Ballona Creek near Mesa Drive and approximately three quarters of a mile southeast of Locality 1 an upper sand member rests on a micaceous sandy clay and the contact line apparently marks the water table in this region. Below this occurs a massive bed of peat. At Locality 4 (Vernon Avenue and 11th Avenue) a short distance east of the Ballona Creek locality, narrow bands of peat are present below a stratum of gray sand. These are followed below by dark carbonaceous sands and gray sands. This portion of the section lies above, and is apparently conformable with, gravelly sand.

No great differences in elevation are noted when the three stations (Localities 1, 3 and 4) are compared. It does not appear unlikely, in view of the

relatively short distances that separate these localities, that portions of the sections containing peat at Localities 3 and 4 represent the same period of accumulation as that recorded by at least a portion of the deposits at the human locality. It seems premature, however, to state definitely that the dark carbonaceous sand horizons noted at the human localitity (Locality 1) are the equivalent of the peat beds at Localities 3 and 4. There remains the possibility that these bands represent a later accumulation. More information is needed concerning the beds that underlie the deposits containing the human remains. Undoubtedly, further trenching of the region, as the installation of the outfall sewer progresses, will throw light on this relationship.

At Locality 5, east of the Inglewood Fault and perhaps a mile or more west of Locality 1, a splendid exposure is seen in the sewer trench (Section 10), having a depth of 24 feet. Near the bottom of the trench are exposed clays of Upper Pliocene age, containing marine shells. These deposits have a northeasterly dip and are overlain unconformably by a heavy boulder bed, consisting of granitic materials. Some of the boulders exceed a foot in diameter. Toward the top of the bed are found arkosic sands and large boulders. The accumulation shows decided cross-breeding in places and is undoubtedly of fluviatile origin. Above the boulder bed is a greenish clay with upright stems of plants, and above this is peat. This deposit appears to rest unconformably upon the boulder bed. Laterally the peat may grade into carbonaceous earth.

At Locality 6, just north of Locality 5, a tibia presumably of a camel was found in the course of the excavation for a temporary sewer. This specimen, now in the collections of the Los Angeles Museum, was found over a year ago. It is reported to have come from a depth of 18 feet, although no definite information is now available regarding its position. It is possible that the specimen occurred distinctly higher in the section. A small amount of material in which the tibia was imbedded still adheres to the bone and suggests that the specimen occurred in an arkosic sand. The section at Locality 6 below the capping of soil consists of peat and peaty earth to a depth of 9½ feet. Pockets of shells, comparable to those found at Locality 1, occur in this material. Below this peaty earth is a greenish, micaceous sandy clay with numerous stems or roots, some of which extend downward from the peat beds into the sandy clay. A fragmentary toe bone of a horse was found in this deposit. The sandy clay is three feet thick and is underlain by arkosic sand. The exact relationship of the arkosic material to the sandy clay was not determined. It should be noted from this description that the section at Locality 6 closely resembles that at Locality 5.

The tibia is similar to but not identical with the tibia of the large camel, *Camelops hesternus* (Leidy), of Rancho La Brea. The specimen does not show the type of preservation exhibited by the human remains. If the specimen came originally from the arkosic sand associated with the boulder bed, it suggests Pleistocene age for the latter deposit.

In the Baldwin Hills immediately to the south occur clays and sands containing marine shells indicating Upper Pliocene age. Gravels and sands, referred to the San Pedro Pleistocene, are also present. The pebbles in the gravel beds are usually small, frequently possess ferruginous stains, and do not consist exclusively of granitic rocks. It is evident that there is no deposit exposed in the Baldwin Hills comparable to that of the boulder bed. The latter deposit presumably accumulated after the deposition of these San Pedro beds and, therefore, is at least later than a portion of San Pedro time. It would be of much interest to determine, if possible, the stage or stages of the Pleistocene represented by the deposits exposed in the Baldwin Hills.

The source of the material constituting the boulder bed was presumably in the western part of the Santa Monica Mountains or in the San Gabriel Range. It does not appear likely that the accumulation could have been formed under present climatic conditions by such a stream as the Los Angeles River even if we grant greater carrying power in flood seasons and a course through this region rather than its present course. The course of the old Los Angeles River is still very obscure.

If we concede the Pleistocene age of the boulder bed based on the evidence cited above, then the peat and peaty earth are later, perhaps distinctly later, at least at Localities 5 and 6. Should the deposits underlying the beds containing the human remains prove to be the equivalent of the peat beds, then these deposits are also later than the latest Pleistocene accumulation recorded in that region.

A second possibility presents itself if we regard the deposits exposed at the human locality or a portion of these deposits as having accumulated in ponded waters on the flood plains of the stream responsible for the deposition of the boulder bed. The materials in which the human remains occur and those above this horizon resemble, however, more closely in their lithologic characters the argillaceous sands, carbonaceous sands, and peat at Localities 5 and 6 than they resemble the boulder bed and associated arkosic materials. Undoubtedly the trenching now in progress between Localities 5 and 1 will furnish valuable information bearing on the problem of the relationship of the boulder bed and overlying sands and peat to the deposits in which the human remains were collected.

Lastly, it should be noted that the latest deposit in the immediate vicinity of the human locality is the

material constituting the very small alluvial fans in front of the gullies incising the northern front of the Baldwin Hills.

CONCLUSION

It is apparent from a preliminary investigation of the occurrence of the recently discovered human remains in Los Angeles that the evidence at present available does not point unequivocally to Pleistocene age of the deposits containing the human material. The fact should be emphasized, however, that the sequence of physical events and of faunal changes in the Pleistocene of California requires much careful investigation before a stage of understanding is reached comparable to that represented by Pleistocene history as now recorded in the region east of the Rocky Mountains.

Extensive trenching of the western region of Los Angeles now in progress should result in fuller knowledge of the geological events recorded in the area under consideration, and should establish more definitely the relationship of the Pleistocene deposits and faunas to those of the Recent. While the present report has not shown that the deposits containing the human remains are old in the sense that they belong to a geological period antedating the Recent period, the age of these beds and of the human remains might well be measured in terms of thousands of years, but not necessarily tens of thousands.

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"ANALYZED SOUND" IN NATURE

THE following is an account of an interesting group of phenomena, fundamentally alike, which have been noticed and described independently by five different observers, including myself. Comparing notes with one of these, Dr. Edward W. Emerson, resulted in his suggesting that I should put a description of his observations and mine together in an article, including also the description of two similar observations left with him by his uncle, Dr. Charles Thomas Jackson.[1] Soon after this conversation still another observation of a similar nature was made by Mr. Raymond Emerson, Dr. Emerson's son, and I am fortunate in being able to include a description of this which he has kindly furnished me. Still more recently Mr. W. Rodman Peabody has told me of another instnace of the same sort of phenomenon.

I can best place the data before the reader by simply giving the descriptions of these observations exactly as they were furnished me, and in the case of my own observation, as I wrote it down soon after I made it.

[1] Dr. Jackson was the geologist and chemist whose observation in 1842, of ether anesthesia, induced in himself, led to the introduction of this practice into surgery by Morton in 1846.

ANALYZED SOUNDS[2]

While engaged in the geological survey of Maine, I had occasion to make a trip through the forests from Farmington to Saddleback Mountain—and, after passing over a hill, we suddenly came in view of Saddleback between which and our party lay a large dismal swamp with a lake in the midst of it. The huge mountain range covered with snow stretched away for a great distance and presented so magnificent a sight as to call forth a shout from my party. The echo, after some moments, came back in musical tones, though the shout was anything but musical.

A fierce Indian war whoop was returned to us in the softest musical tones, not one of the discords being heard.

A gun was fired and the report came back in a *feu de joie* of long continuance and decidedly musical in its effect. Very discordant yells were made to try the effect, but only musical tones were returned. These interesting acoustic experiments were repeated for a long time with much amusement to the party—to me the matter seemed full of meaning—and was a subject of much reflexion.

While engaged in the earliest mining researches on Lake Superior, in 1844, a very curious instance of analyzed sounds was observed by F. W. Davis and myself—I had been sick and in consequence remained at the log cabin we had erected at Eagle Harbor on Keweenaw Point and sent out our miners to open a mine at Eagle River eight miles distant. Davis and myself set out one day to shoot some pigeons and while wandering not far from the shore in the cedar swamp near the harbor, we both suddenly stopped and listened to a sound which had reached our ears.

It was a melodious and solemn dirge in slow music like that I have sometimes heard in European cathedrals.

We listened for some moments before speaking, wondering where this music could come from. At first we thought it might be that our party of miners were returning and were chanting in the forest. To ascertain if such was the case, we ran in the direction the sound appeared to come from but in a short time we lost it. We then went down to the lake shore and looked up and down the coast from the point, but there was no boat and not a human being to be seen and no music was heard.

On returning to the spot where we first heard it, it was still heard there, but moving a few hundred yards either way, we lost it again. Much puzzled with this strange music of the woods, we returned to our cabin and found that old Jacob, our cook, was then engaged in his operations of making bread and had not been out of the cabin and had not been singing—indeed, he was no musician.

[2] From the notes of Dr. Charles Thomas Jackson, chemist and geologist.

To account for these musical tones, I supposed it was a case of analyzed sounds and on comparing the measure, I found that it corresponded to the rote of the waves on the pebbly shore. The vibration of the air produced by the constantly recurring surges was analyzed by the forest and we stood where we heard it in a focus of the echo. Similar phenomena were noticed by the late Francis C. Gray, Esquire, at the Picture Rocks on the north shore of the lake, music like that of a deep-toned organ coming from the pulpit rock, an inaccessible cliff of sandstone.

Thus it appears that when sounds mingled with discords traverse the forest, the foliage absorbs all the discordant notes and the reflected and returned sounds are all pure liquid harmonies.[3]

Is not this also a representation of human history? In the lapses of time the errors and wrongs of the past are lost and only the soft and pure music of truth is reflected back in the distant future—only the heroic and that worth preserving remain and errors are eliminated from the biography of men—and the good they have done lives after them.

Fear not then that any good you have done will be lost, or that malice and envy will poison the history of your good deeds. Time will, with its analytic prongs, separate, absorb and extinguish all the evil that has troubled the present and will fill the future with the harmonies of your noble actions and generous sacrifices.

"THE MUSIC OF NATURE"[4]

In 1862, July, when I was journeying westward with an emigrant train on the California trail, we rested in camp one Sunday to recruit the horses and mules. It was on the North Branch of the broad River Platte not far from Fort Laramie nearing the foot-hills of the Rocky Mountains. We were, therefore, at a considerable altitude. The air was fine and dry, the country an alluvial plain covered with grass, bounding the course of the river which, shallow and shifting, spread its broad waters, yellow and turbid with fine sand, over much country, even in summer. I was tired of the talk of the dozen or two of men, women and children, but the rare sight of a grove which had escaped the prairie fires attracted me. I walked alone into this group of large cotton-wood trees. These and the fringe of dwarf-willows along the stream attracted me after riding and walking for continuous weeks over treeless green plain. I left my mates for the restful solitude that the trees offered. As soon as I arrived there I was surprised by music strangely sounding in the direction of our camp. Yet whence did it come? When I reached camp, and asked whence, no one understood what I was talking about. There had been no music. Every one about camp was quite otherwise employed and no practical joker was about. Some years after, my mother's brother, Dr. Charles Thomas Jackson, surveying in Maine, had a similar experience, finding that at a certain distance his voice would carry in either direction with great distinctness, while nearer, perhaps in each direction, was silence.

The following account was furnished by Mr. Raymond Emerson in a letter dated May 13, 1922:

I was on a gasoline tug boat coming up the Slave and Athabasca rivers in Alberta, Canada, last September from Ft. Fitzgerald and Ft. McMurray. There was a strong current from 3 to 4 miles per hour running, and our boat consequently kept pretty close in shore to take advantage of all the eddies at the bends of the river. The shores were heavily wooded with spruce, jack pine, birch and poplar, and there were many stretches of several miles where the trees had been killed by fire. The tug was pushing a loaded scow and the exhausts of her engines were loud and rather sharp. The sound of these exhausts echoed back clearly from the high banks, but where the banks were low the echo was apparently broken up and came back as a musical rhythmical sound very much like the thrumming noise produced by a person striking the strings of a large harp. This sound was very noticeable and attracted the attention of all the men on both scow and tug. As soon as my attention was drawn to this musical sound I watched carefully to see how it varied with our distance from the shore, etc., and the result of my observation was that whenever we approached a part of the river with low banks and with a heavy growth of fire-killed trees, the sound became more musical, and its resemblance to the sound produced by a harp increased, where the trees were green it was less apparent, and where the banks were high and the boat close under them the musical quality was lacking and the echo came back clear and sharp—a true reflection of the report of the exhaust. The only explanation that occurred to me was that the sound waves were broken up by striking against the dead trees, which of course did not present a uniform reflecting surface; but each tree reflected a part of the sound, and this reflection was broken up into innumerable parts on account of the varying element of distance. When the boat moved a hundred yards or more out into the stream the musical effect decreased and disappeared entirely when we were over 200 or 300 yards away. I should add to the statement that both rivers have an average width of well over a mile, so that whatever echo we had came from the nearer bank only.

My own observation follows.

A SOUND WAVE PRISM

On July 27, 1903, while on a journey through the Bighorn Canyon in Southern Montana by boat, I set out in the morning from our camp at the mouth of the Bull Elk Creek to walk down stream along the right bank of the river, accompanied only by my dog. As I was walking down one of the sandy beaches on the river's edge I heard a howl, beginning at a high pitch and sweeping down into the bass clef. I stopped short and looked around; I could hear nothing but the roar

[3] Dr. Jackson told R. W. E. that this phenomena had never been treated scientifically except in a paper by Dr. Wollaston, and he called it "Analyzed Sound" E. W. E.

[4] Early experience of Edward W. Emerson.

of the river. I took a step backward and the howl reversed itself, starting low and rising to a high pitch. I then moved back and forth over the same ground and found the noise to be no more than the roar of the river, rising and falling like a siren. It seems the rocks around me formed a sort of sounding-board, treating the roar as a prism treats sunlight, placing the tones according to their pitch, the high in one place and the low in another.

I have no doubt the observation could be repeated if the exact spot were revisited at approximately the same time of year, *i.e.*, when the river was at the same height. As nearly as I can recall, the spot was only a few yards (probably five or ten) from the water's edge, and probably not more than a mile down stream from Bull Elk Creek.

Within a few days Mr. W. Rodman Peabody has described to me an interesting case of this phenomenon which he experienced some years ago.

He was travelling with a pack train in the Canadian Rocky Mountains. Some other members of the party had left the pack train in the morning and set out on foot on an all day hunting excursion. Late in the afternoon Mr. Peabody left the pack train at a convenient camping place and set out on foot to find the hunting party at a designated rendezvous where two streams met. He was scrambling down a steep ravine into the canyon where he expected to find the others, when at a point about a hundred yards from a mountain torrent he heard clearly what he took to be a man's voice. He said to himself, "That's W. trying to sing. It's out of tune; so it must be W." The point where he heard it was surrounded by coniferous trees. As he went on, the sound disappeared, but so sure was he that it had been his friend's voice that he fully expected to see him when he emerged from the woods a few yards farther on. To his surprise there was no one in sight. He searched for them till dusk, and then scrambled back up the ravine to the pack train. On his return he heard exactly the same sound as he traversed the place where he had heard it before.

He described it to the guides, and they said they had heard the Indians speak of hearing such things in the mountains, although they had not themselves experienced it. Mr. Peabody concluded that if these guides, although spending their lives outdoors in the mountains, had never noticed this striking phenomenon, it must be of rare occurrence.

Dr. Emerson, in sending the above descriptions, called attention to a passage in the poem entitled "May Day" by his father, R. W. Emerson, which clearly was suggested in part by the observations of Dr. Jackson.

None can tell how sweet,
How virtuous, the morning air;
Every accent vibrates well;
Not alone the wood-bird's call,
Or shouting boys that chase their ball,
Pass the height of minstrel skill,
But the ploughman's thoughtless cry,
Lowing oxen, sheep that bleat,
And the joiner's hammer-beat,
Softened are above their will,
Take tones from groves they wandered through
Or flutes which passing angels blew.
All grating discords melt,
No dissonant note is dealt,
And though thy voice be shrill
Like rasping file on steel,
Such is the temper of the air,
Echo waits with art and care,
And will the faults of song repair.
So by remote Superior Lake,
And by resounding Mackinac,
When northern storms the forest shake,
And billows on the long beach break,
The artful Air will separate
Note by note all sounds that grate,
Smothering in her ample breast
All but godlike words,
Reporting to the happy ear
Only purified accords.
Strangely wrought from barking waves,
Soft music daunts the Indian braves,—
Convent-chanting which the child
Hears pealing from the panther's cave
And the impenetrable wild.

In Volume IX of the Centenary Edition of the complete works of R. W. Emerson, there appears an explanatory note (inserted by Dr. Emerson) referring to this passage in the poem, and giving a condensed statement of his own observation and those of Dr. Jackson, which shows the origin of the idea expressed in the poem. In this note Dr. Emerson mentions waves breaking on the shore of the river as the source of the sound in his own observation.

All the phenomena described above seem to be instances of differential reflection or absorption of sound waves of different pitches. In every case the source of the sound—waves on a beach, roar of a river, exhaust of motor boat or discordant human voice—was one in which many pitches were present. Something in the surroundings, usually trees, must have separated the sounds according to pitch, placing those of one pitch in one place and those of another pitch elsewhere. In this respect the phenomenon appears analogous to that of white light being broken up into pure spectral colors by a prism or diffraction grating. In the original description of my own observation I made no mention of trees. As I recall it, the place where I heard the "howl" was an open one, but there were scattering trees not far away. It is interesting that this phenomenon has been noted in such a variety of natural conditions.

ALEXANDER FORBES

HARVARD MEDICAL SCHOOL

SCIENTIFIC EVENTS

PITTSBURGH TRAINING SCHOOL'S LECTURE COURSE ON SCIENCE AND EDUCATION

THE Pittsburgh Training School for Teachers is an institution under the direct control of the Board of Public Education. In 1921 the Alumnae of the Training School, under the direction of Dr. H. B. Davis, principal of the school, established an annual course of lectures on the scientific aspects of education. The thought of the organization was that such a contribution to the intellectual life of the city would be a more significant expression of its real and vital interests than the usual round of social affairs. These lectures are free to the public and have usually filled the lecture hall of the Carnegie Central Library with an average audience of six hundred.

In the establishment of the course it was primarily conceded that, if there is a science of education, then original investigators ought to be able to give light on the subject, but, if there should prove to be no such science, then we ought to cease talking about it. The lecturers who have thus far appeared, together with their subjects, are as follows:

SEASON OF 1921

The significance of intelligence levels in a democracy: H. H. GODDARD, Columbus, Ohio.

Experimental studies in the emotional life of children: JOHN B. WATSON, New York City.

Psychoanalysis in the light of modern psychiatry: ADOLPH MEYER, Johns Hopkins University.

The relation of heredity to education: HERBERT S. JENNINGS, Johns Hopkins University.

SEASON OF 1922

The problem of the nervous child: CHARLES MACFIE CAMPBELL, Harvard University.

The effect of emotions on the body: WALTER B. CANNON, Harvard University.

Psychology and Science: EDWARD B. TITCHENER, Cornell University.

The rôle of education in race development: EDWIN GRANT CONKLIN, Princeton University.

SEASON OF 1923

Do types of growth determine mind?: CHARLES R. STOCKARD, Cornell Medical School, New York City.

The new psychology and the teacher: THOMAS W. SALMON, Columbia University.

The population problem: RAYMOND PEARL, Johns Hopkins University.

Some human inadequacies and their relation to the internal glandular system: WALTER TIMME, New York City.

This course of lectures has already earned the reputation of offering the most evident results of scientific investigation that the city of Pittsburgh affords.

H. B. DAVIS

PITTSBURGH TRAINING SCHOOL FOR TEACHERS

BARRO COLORADO ISLAND BIOLOGICAL STATION

As recently noted in SCIENCE, the biological station on Barro Colorado Island in Gatun Lake (Panama Canal), which has been developed by the Institute for Research in Tropical America, with the cooperation of the division of biology and agriculture of the National Research Council, now has laboratory and housing quarters sufficient for a limited number of workers. Such workers enjoy certain commissary privileges and may receive material assistance in going to and returning from the Canal by means of a limited number of steamer passes generously provided by the United Fruit Company, and by transportation on army transports just authorized by special order of the Secretary of War. By this order scientific workers furnished with proper credentials from the chairman of the executive committee of the Institute for Tropical Research will be carried on government transports when space permits. Not more than four applicants may be scheduled for any one transport. These transports usually leave New York between the 5th and 8th of each month and San Francisco between the 8th and 11th of each month.

Arrangements have already been made by several scientific men to work at the station this summer, but a few more can be accommodated. In the absence from Washington of Dr. David Fairchild, Dr. Thomas Barbour is acting chairman of the executive committe of the Institute for Research in Tropical America, and inquiries should be addressed to him, either at the Museum of Comparative Zoology, Cambridge, Massachusetts, or in care of the Division of Biology and Agriculture, National Research Council, Washington, D. C.

VERNON KELLOGG,
Permanent Secretary,
NATIONAL RESEARCH COUNCIL

THE THIRD PAN-AMERICAN SCIENTIFIC CONGRESS

ON December 20, the third Pan-American Scientific Congress will assemble at Lima, Peru, and will continue in session for two weeks. The organizing committee is now actively engaged in making arrangements for the congress, and cooperating committees in the different republics of the American continent are also engaged in arousing interest among the scientific and educational institutions of the respective countries in the forthcoming meeting.

Prior to 1908 congresses of a scientific character had been held at irregular intervals at which only representatives of the Latin-American republics were present, but in that year the first Pan-American scientific congress assembled at Santiago, Chile, at which nineteen republics, including the United States, were represented. The second congress was held at Washington in 1915–16, at which delegates from all the American republics were in attendance.

The scientific congresses have been instrumental in bringing together the leaders of scientific and educational thought of the republics of the American continent. The interchange of views and opinions which takes place at these meetings and the contacts established between the scientists and educators of the American republics are of great importance in the development of closer cultural and economic ties between the countries of the western hemisphere.

Reports received from Lima indicate that the forthcoming congress will be fully as important as its two predecessors. At the meeting held at Santiago, in 1908, ten associations and institutions of the United States sent delegates to the congress and in all probability as large a delegation will go to Lima in December.

The work of the congress will be sub-divided into sections devoted to anthropology and history; physics and mathematics; mining, metallurgy and applied chemistry; engineering; medicine and sanitation; biology and agriculture; private, public and international law; economics and sociology, and education.

GEOLOGY AT THE TORONTO MEETING OF THE BRITISH ASSOCIATION

AMONG overseas geologists who will be present at the Toronto meeting of the British Association are the following:

President of Section C—W. W. Watts, D.Sc., LL.D., F.R.S., professor of geology, Imperial College of Science and Technology and foreign secretary of the Mineralogical Society, London. Will speak on some phase of economic geology.

Vice-President—Gertrude Elles, D.Sc., Newnham College, Cambridge, former president of Section C, Liverpool meeting.

Recorder—W. T. Gordon, M.A., D.Sc., F.G.S., professor of geology, King's College, London.

F. A. Bather, M.A., D.Sc., F.G.S., F.R.S., head of the department of geology, British Museum.

P. G. H. Boswell, O.B.E., D.Sc., F.R.S., professor of geology in the University of Liverpool.

Arthur Hubert Cox, professor of geology in University College, Cardiff.

J. S. Flett, O.B.E., M.A., D.Sc., F.R.S., director of the geological survey of Great Britain and the Museum of Practical Geology.

H. L. Hawkins, D.Sc., F.G.S., professor of geology, University College, Reading.

G. Hickling, D.Sc., F.G.S., professor of geology and botany, Armstrong College, Newcastle-on-Tyne.

Sir Thomas Holland, F.G.S., F.R.S., rector of the Imperial College of Science, London. Delivers one of the evening discourses, during the meeting, on the subject, "The formation and destruction of mineral deposits."

Owen Thomas Jones, D.Sc., professor of geology in the University of Manchester; formerly of the geological survey of Great Britain.

Sidney Hugh Reynolds, Sc.D., professor of geology in the University of Bristol.

William Johnson Sollas, D.Sc., F.R.S., professor of geology and paleontology in the University of Oxford, and ex-president of the geological society of London.

L. J. Spencer, D.Sc., of the British Museum (Natural History), editor of *Transactions* of the mineralogical society of London.

W. B. Wright, of the Manchester branch of the geological survey of England.

GIFTS TO HARVARD UNIVERSITY

SUPPLEMENTING the report of Bishop Lawrence made to the alumni of Harvard at their annual meeting in which gifts of $9,289,595 to the university were announced, gifts which had come as the result of the university's drive to add to its equipment, President Lowell has announced other bequests to the university amounting to $5,158,000. These include:

An anonymous gift of $50,000 for the Arnold Arboretum.

From the same donor to found a George Lincoln Goodale Fund in memory of Professor Goodale, to be used for the current expenses of the Botanical Museum, making from that donor $100,000.

From the estate of William Brewster, $60,000, three quarters of it to be used for the payment of the salary of a competent ornithologist and the remainder for the renewal and repair of cases of birds in the museum.

From the estate of Harry Butler, $100,000.

From the Class of 1903, on account of its 25th Anniversary Fund in the future, $34,500.

From the estate of Joseph R. DeLamar for the Medical School (an additional) $100,000.

From the General Education Board for the Medical School for the endowment of the department of psychiatry and neuropathology, $386,000.

From the estate of A. Paul Keith, unrestricted (an additional) $1,964,000.

From Mr. and Mrs. George A. McKinlock toward the dormitory to be named in memory of their son, George A. McKinlock, Jr. (additional) $55,000.

From the estate of Hiram F. Mills for investigation of cancer, $103,000.

From the estate of William F. Milton $1,030,000.

From Miss Susan Minns, the income to be used for the Botanical Museum, $50,000.

A bequest from Mrs. Lewis H. Plympton, $50,000.

From the Rockefeller Foundation for the School of Public Health, $118,000.

From the estate of Miss Annie Blake Shaw, a bequest to found the Samuel Parkman Shaw Fund for loans or gifts to deserving undergraduates, $50,000.

From Galen L. Stone for purchase of the Bruce collections of Chinese paintings for the Fogg Museum, $30,000.

From the estate of Morrill Wyman for the Medical School (an additional) almost $40,000.

Other gifts, $784,000.

SCIENTIFIC NOTES AND NEWS

DR. ELIHU THOMSON, one of the founders of the General Electric Company and director of the company's research laboratory at its Lynn works, will receive two honors in England in July. The University of Manchester will confer the honorary degree of doctor of science upon him July 4, and on July 10 he will receive the Lord Kelvin gold medal in London. Professor Thomson is the first American to receive this honor.

THE Belgian Order of Leopold has been bestowed by King Albert on Dr. Leo Hendrik Baekeland, president of the American Chemical Society, and professor of chemical engineering at Columbia University.

AT the meeting of the American Medical Association in Chicago, Dr. William D. Haggard, professor of surgery in Vanderbilt University, was elected to the presidency for the coming year.

DR. GEORGE GRANT MACCURDY, curator of anthropology in Yale University, has been appointed research associate in prehistoric archeology at the university, with professorial rank.

PROFESSOR BORIS WEINBERG has recently been appointed director of the Central Physical Observatory at Leningrad (formerly Petrograd).

THE council for the American Physiological Association has awarded the Porter fellowship for this year to Dr. Raymond Hausler, instructor in anatomy at the University of Oregon Medical School. Dr. Hausler will work in Professor A. J. Carlson's laboratory at the University of Chicago.

DR. NORMAN COMBER has been elected to the chair of agricultural chemistry at the University of Leeds, England, in succession to Professor C. Crowther, who is now principal of the Harper Adams Agricultural College.

DR. FREDERICK G. BANTING, of the University of Toronto and discoverer of insulin, received the honorary degrees of doctor of laws and doctor of science from the University of Chicago, the degree of doctor of science from Yale University and the degree of doctor of laws from the Western University of Medicine, Ontario.

PROFESSOR JOHN MERLE COULTER, head of the department of botany at the University of Chicago, received the honorary degree of doctor of science at the June commencement of Lake Forest University.

THE University of Pittsburgh conferred at its recent commencement the degree of LL.D. on Dr. William James Mayo, chief of staff of the Mayo Clinic, Rochester, Minnesota, who gave the commencement address; the degree of Sc.D. on Douglas Stewart, director of the Carnegie Museum, Pittsburgh, and the degree of Pharm.D. on Edwin Leigh Newcomb, professor of botany in the University of Minnesota.

AT the meeting of the Royal Astronomical Society on June 13 the gold medal of the society was presented to Professor A. S. Eddington, Plumian professor of astronomy and experimental philosophy in the University of Cambridge.

THE Royal Anthropological Institute has founded a Rivers memorial in memory of Dr. W. H. R. Rivers, who was president of the institute at the time of his death. The medal will be awarded for special meritorious anthropological work in the field. All British subjects and anthropologists of other nations who are fellows of the institute will be eligible.

THE gold medal of the British Medical Association has been awarded to Dr. Henry B. Brackenbury for services to the association and the medical profession.

ALEXANDER G. MCADIE, professor of meteorology at Harvard University and director of the Blue Hill Observatory, has been elected a member of the international cloud committee.

DR. F. H. MCMECHAN, secretary general of the American Society of Anesthetists, has been chosen first American honorary member of the section of anesthetists of the Royal Society of Medicine of England.

DR. W. A. MURRILL, supervisor of public instruction at the New York Botanical Garden, has returned from his expedition to South America, where he made stops in Argentina, Uruguay, Brazil and British Guiana.

NEIL M. JUDD, curator of American archeology, National Museum, left Washington on May 16 to resume direction of the explorations of the National Geographical Society at Pueblo Bonito. This prehistoric ruin, one of the largest and most important in the southwestern United States, is the most famous unit of the Chaco Canyon National Monument. The society began its explorations in Pueblo Bonito in 1921; it is hoped that the work will be concluded by the end of 1925.

PROFESSOR JULIUS STIEGLITZ, chairman of the department of chemistry at the University of Chicago,

recently gave at Johns Hopkins University a series of lectures on the Charles E. Dohme memorial foundation, his general subject being "Chemistry and recent progress in medicine."

CHARLES A. KOFOID, professor of zoology at the University of California, delivered the commencement address at the University of Washington.

JOHN L. BEAR, an anthropologist of the Smithsonian Institution and a member of the faculty of George Washington University, died on May 28 in Southeastern Panama, where he had gone as a scientific member of the Marsh expedition, which left New York in January to study the so-called "white Indians" of Darien.

DR. BEVERLY ROBINSON, formerly professor of clinical medicine at Bellevue Medical College, New York, died on June 20, aged eighty years.

THE death is announced of Kenneth Mackenzie, reader in agriculture at Cambridge University, late director of the university farm and consultant to the Institute of Animal Nutrition, at the age of fifty-one years.

DR. ROBERT KENNEDY, St. Mungo professor of surgery in the University of Glasgow since 1911, died on June 3, at the age of fifty-eight years.

DR. S. GABRIEL, honorary professor of chemistry in the University of Berlin, has died at the age of seventy-three years.

DR. RICHARD PALTAUF, director of the Institute of General and Experimental Pathology in Vienna and a well-known writer on the pathology of the blood and diseases of metabolism, has recently died at the age of sixty-seven years.

THE London Mathematical Society recently elected as honorary members the following: L. Bianchi, A. Einstein, J. Hadamard, E. Landau, H. Lebesgue, T. Levi-Civita, L. Prandl and A. Sommerfeld. Four of these eight new honorary members are professors in German universities. The other four are equally divided among the French and the Italian universities.

THE American section of the International Mathematical Union has elected the following delegates to represent the United States at a meeting of the union in Toronto, August, 1924: Professors A. B. Coble, L. P. Eisenhart, E. V. Huntington, R. G. D. Richardson, H. L. Rietz and Virgil Snyder.

AT the April meeting of the Royal Society of Western Australia a proposal was brought forward by the council to institute a gold medal to be awarded from time to time for distinguished and pioneer work in connection with science in the state. The celebration in June of the centenary of the birth of Lord Kelvin was thought a fitting occasion for the inauguration of this new award. The scheme was approved by the society, and the further proposal was adopted that the first award should be made to W. J. Hancock, D.Sc., for his work in connection with radiography. Dr. Hancock was a pioneer in X-ray work in western Australia, and during a period of 22 years he acted as honorary radiographer for the medical department, the Perth Hospital and the Military Base Hospital, Fremantle.

THE General Electric Company is arranging for a conference of college professors to be held at its Schenectady works from July 7 to August 9. It is the plan to have each physicist spend the greater part of his time in the department in which the work most closely coincides with his interests. Twice a week visits of inspection will be made throughout the plant, followed by round-table conferences with General Electric engineers.

MCGILL UNIVERSITY has received $650,000 from the Rockefeller Foundation for the establishment of a school of public health in connection with the faculty of medicine. The gift will permit of the extension of the department of hygiene and the public health, nursing and Connaught laboratories, which are dealing with the manufacture of insulin.

CAMBRIDGE UNIVERSITY has received from Sir Jeremiah Colman, of St. John's College, the sum of £2,000 for a library for the school of biochemistry.

THE Canadian manufacturers' association has approved the creation of a national institute of scientific research for the Dominion. A fund of $1,000,000 is to be raised.

THE National Association of Audubon Societies has received as a gift from Mrs. Grace Rogers, sister of the late Paul J. Rainey, hunter and explorer, a tract of more than 26,000 acres of marsh lands for a bird sanctuary in Vermilion Parish, Louisiana.

THE committee on scientific research of the American Medical Association has granted to Dr. Herbert M. Evans, of the University of California, $400 for his work on the anterior hypophyseal hormone.

THE American Roentgen Ray Society has offered a prize of $1,000 to the author of the best piece of original research in the field of the roentgen ray, radium or radioactivity. The competition is open to any one living in the United States or its possessions or elsewhere in the western hemisphere. Work submitted for the prize carries with it the understanding that the subject-matter will remain open to free use for the public good. The prize is offered for the promotion of useful research with the approval of the National Research Council, and to commemorate the name of Dr. Charles Lester Leonard, who was a martyr to the roentgen ray.

AT a meeting on June 3, 1924, the board of directors of the Agricultural and Mechanical College of Texas authorized the establishment of a graduate school and a school of arts and sciences, the latter to be coordinated with the existing schools of agriculture, engineering, veterinary medicine and vocational teaching. Dr. Charles Puryear, for many years dean of the college, was appointed dean of the graduate school, and Charles E. Friley, registrar and secretary of the general faculty, was appointed dean of the school of arts and sciences.

THE St. Mary's Group of Hospitals, comprising six hundred beds, has by agreement become the university hospital of the St. Louis University School of Medicine, the university having full control of the medical and educational activities. The first step in the complete establishment of this relationship has been the organization of the department of medicine on a full-time basis. In addition to the instructors who have been previously conducting the department, the following full-time men have been appointed: Ralph A. Kinsella, professor of medicine and director of the department, formerly associate professor at Washington University; Goronwy O. Broun, associate professor of medicine, formerly instructor of medicine at Harvard University; Charles H. Hitchcock, assistant professor of medicine; Alfred P. Briggs and Octavio Garcia, instructors in medicine.

FOLLOWING the program prepared by the colloid committee of the National Research Council, the second National Colloid Symposium was held in Evanston, Ill., June 18 to 20. More than 250 registered and participated in the social and scientific activities, which included attendance at the June 20 meeting of the Chicago Section of the American Chemical Society. Harry N. Holmes and Ross A. Gortner presided at the symposium meetings.

ACCORDING to *Nature*, the National Union of Scientific Workers of England has issued a strongly worded circular against the perpetuation of international passions raised by the war by the continued existence of the so-called International Scientific Unions founded in 1919 by the International Research Council and managed by an executive committee of which Sir Arthur Schuster is general secretary. The National Union points out that the council exists not to promote international cooperation but to exclude ex-enemy nations and maintains that it is the desire of the majority of scientific men in Great Britain to ignore the unions so established. It instances the recent genuinely international physiological congress at Edinburgh and psychological congress at Oxford as signs of the growing opposition to the policy of the Research Council.

RESEARCH plans are now being formulated in the Forest Service for the establishment of a forest experiment station in the Pacific Northwest to handle the forestry problems of Washington and Oregon. The more pressing problems of the Pacific Northwest have to do with the growth, management and protection of the Douglas fir and coastal forest types, as well as with the management of the yellow pine forests on the eastern side of the Cascade range. This new station will be on a par with those established a year ago in the Lake States and the northeastern forest regions. Plans are also under way for a material enlargement of the forest research work in the southern pine region. The work in the south has been under way for three years, but this year, due to an increase in the appropriation given the Forest Service for research, it will be possible to make this station the largest of all the experiment stations the Forest Service is now operating. The problems of the southern pine region are those involved in the production of naval stores, the proper forest management of the southern pine forest, the rate of growth of young trees following cutting, the establishment of reproduction and the influence of fire upon rate of growth.

THE faculty of applied science, having in charge the Schools of Mines, Engineering and Chemistry of Columbia University, has introduced important new courses into the program of study and has established closer cooperation with the Columbia University School of Business in municipal engineering. Cooperation has also been brought about with the National Institute of Public Administration, formerly the Bureau of Mining Research. Students in the Columbia University civil engineering course will be able to take advantage of the opportunities offered by the National Institute of Public Administration in courses for the training of the modern city manager.

UNIVERSITY AND EDUCATIONAL NOTES

GIFTS and pledges totaling $2,719,000 for buildings and endowment funds, made to Yale University during the university year 1923–24, were announced at the commencement exercises. In addition gifts of Yale alumni to the university this year reached a total of nearly half a million dollars.

PROFESSOR MARK E. PENNY, of the school of education at Ohio State University, has been elected president of James Millikin University.

DR. A. ROSS HILL, of Kansas City, formerly president of the University of Missouri, has been elected president of the University of Oklahoma.

DR. HAROLD ALBERT WILSON, professor of physics in the Rice Institute, Texas, has been appointed to the chair of natural philosophy in Glasgow University.

GEORGE C. FRACKER, dean and head of the depart-

ment of psychology at the University of Dubuque, has been appointed professor of psychology and philosophy at the University of Arkansas.

DR. ASA A. SCHAEFFER, of Clark University, has been appointed professor of zoology at the University of Kansas.

R. C. RICHARDS, formerly of Trinity College, Cambridge, and fellow of the Institute of Physics, has been appointed Quain lecturer in physics at University College, London.

DR. HENRY BLUMBERG, professor of mathematics at the University of Illinois, is to be on leave of absence during the academic year 1924–25.

HERBERT A. ROGERS, research assistant professor at the University of Minnesota, will be associate professor of psychology at the University of Vermont next year.

DR. WALTER C. KRAATZ, now acting professor of zoology at Miami University, has been elected to the position of assistant professor of biology at the University of Akron.

DR. BRUCE HOUSTON has been appointed assistant professor of chemistry in the University of Oklahoma.

APPOINTMENTS at Brigham Young University have been made as follows: Dr. Milton Marshall, of the University of Chicago, assistant professor of physics; Dr. Carl F. Eyring, of the California Institute of Technology, dean of the college of arts and sciences, and L. John Nuttall, Jr., director of training schools at the university, dean of the college of education.

DISCUSSION AND CORRESPONDENCE

ON THE PROPER WORDING OF THE TITLES OF SCIENTIFIC PAPERS

WHEN Dr. H. H. Donaldson published, in SCIENCE for February 23, 1917, a note entitled "More complete titles," I was too inexperienced in bibliography to appreciate fully its meaning and value. In this note he specifically suggested that there be included the name of the animal, scientific or common or both, and some indication of the group to which it belonged. However, in June of that same year I began work on Volume III of Dr. Bashford Dean's "Bibliography of Fishes," and in 1919, by reason of the lamented death of the talented Dr. Charles R. Eastman, I became the active editor of that work. The marked feature of Volume III is its elaborate and minutely subdivided subject index, and in my part of this I had not gone very far when the incompleteness and misleading wording of a great number of the titles of ichthyological works became painfully apparent.

As our work here progressed, a series of articles bearing more or less directly upon the subject at hand was published in SCIENCE. In the issue for September 3, 1920, Mr. Neil M. Stevens, of the Bureau of Plant Industry, wrote on "The obligation of the investigator to the library." And in that of September 30 of the same year, Mr. Gordon S. Fulcher, of the Corning Glass Works, discussed "Scientific abstracting," as a great time-saver to the researcher.

More to our purpose, however, was the article of Miss Eunice R. Oberley, librarian of the Bureau of Plant Industry, on "Abstracts and titles of scientific articles from the librarian's standpoint," in SCIENCE for November 18, 1921. In this she made a strong plea for such clear and definite titles as will enable the librarian or bibliographer quickly and accurately to catalogue the article so that the investigator *must* find it in his search for the literature.

Next (SCIENCE, August 25, 1922) came the outstanding article by Mr. W. W. Bishop, formerly superintendent of the reading room of the Library of Congress and at present librarian of the University of Michigan, on "The record of science." In this Mr. Bishop made it very clear that "bibliography is the foundation of research." Later, this article was very effectively commented on by Mr. K. C. Walker in SCIENCE under date of October 13.

And lastly I spoke on the subject before the American Society of Zoologists at Cambridge on December 28, 1922, and published in its Proceedings in the *Anatomical Record* of January, 1923, a short abstract entitled "The proper wording of scientific titles."

These various articles would indicate that the matters of abstracting and bibliography, and the proper wording of titles on which they are vitally dependent, are very much in the minds of librarians and bibliographers. Furthermore, the botanists and zoologists are likewise becoming interested, for the Union of Biological Societies of America is even now considering the founding of an abstract and bibliographical journal.

Volume III of the "Bibliography of Fishes" is now done and has been distributed. The outstanding section of this volume is the Subject Index in which the 45,000 titles in Volumes I and II and in the Addenda in Volume III have been minutely analyzed and then brought together, likes with likes. This has been a prodigious undertaking, but we who have done it believe that we have produced the most efficient tool ever made for the use of ichthyologists, and for librarians and bibliographers seeking certain definite references in fish literature. This has been done at great cost of time, labor and money. The time has been increased by many months, the monetary cost by thousands of dollars, and the labor infinitely by defective

and misleading titles which had to be looked up before they could be properly and accurately located in the subject index. And now because of this hard experience, I am moved to discuss the subject which forms the heading of this article in the strong hope that thereby some authors and some editors may be led to the clarifying of titles to the great benefit of future bibliographers, librarians and researchers.

Scientific articles are written that they may be read, but the people who mage them available to readers are bibliographers and libranians, and their efforts are badly crippled by imperfect, misleading, faulty titles. Classification of these faulty titles is not easy, since in kind and degree of faultiness they intergrade, but in order to make clear their faults the following rough distribution will be used: I, indefinite; II, misleading; III, absurd. Of all these some "horrible examples" will now be considered.

First let us consider some titles which by their indefiniteness befog the inquirer's mind. "An unusual sea monster in the bay" might mean a whale, a crocodile, a giant squid, a great shark or any large tropical bony fish, like the sailfish, which attains a length of 12 or 15 feet, and the bay might be any one of a hundred bays. As a matter of fact the title should have read, "*Rhineodon typus,* the whale shark, in the Bay of Bengal." Again, "Notice of an extraordinary fish" might mean any one of a hundred fishes, whereas it refers to the occurrence of the whale shark in Manila Bay. Like these is "On a singular fish from the South Seas," which as a title is absolutely indefinite and practically meaningless. Such also is "Note sur un embryo monstreux." Is this monstrous embryo mammalian, avian, reptilian, amphibian, piscine or one of a possible thousand invertebrate forms? Scores of other utterly indefinite titles might be quoted, but one more will suffice. An old inaugural dissertation was entitled "De Monocerote," and one does not know whether it refers to the Arctic unicorn, to the swordfish or to the unicorn beetle. Another old writer used the same front title, but put in it in I-II-III-order the three unicorn beasts just referred to.

Under the head of misleading titles the following may be quoted: An author entitled his book "Ancient Angling Authors," and one would conclude that he dealt with all, but examination of his book shows that he confines himself to English writers only. Another very authoritative work bears title "Fishing from the Earliest Times," and one would presume that it brings the subject down to the present, whereas it concludes with 500 A. D. A monograph headed "Studies on Lepidosteus" (a Ganoid) is the most authoritative work on the egg-membranes of Teleosts. Another great monograph is entitled "On the Ovary of Selachii," but examination showed that it had to do with the development of the egg, its follicle, membranes, nucleus, yolk, etc. Another reads, "Notes on the Life History of Illinois Fishes," but examination showed *no* life histories at all but brought to light the best paper yet published on the *breeding habits* of the freshwater fishes of the central states of our republic.

Finally, there is a large series of very important papers by one of the leading authorities of the world bearing the title, "On the anatomy and classification of ——— fishes" or "On the osteology and classification of ——— fishes." When laboriously looked up the "anatomy" almost always turned out to be "osteology" and the "osteology" was generally that of the skull only. It would have been just as easy to have the title say *exactly* what these papers dealt with.

Now we come to the third class—titles which may be called absurd, but which, if the editor would permit, I would like to characterize by a stronger term. The first on my list reads "On Mene rhombeus." What is "Mene rhombeus"? The specific name sounds "fishy" but what is the "On"—anatomy, behavior, coloration, embryology, habits—*what?* Only a trip to the library will answer. The German aquarists are the worst offenders in using such titles, yet many of their papers bearing these titles contain admirable observations on habits. Titles of the absurd class might be given *ad libitum,* but only a few are listed—"On the Australian lamprey," "The mormyrid brain," "An electric ray and its young," "About the perch," "The basking shark," "*Ctenodus cristatus.*"

These are sample titles which will make clear some of the difficulties with which we have had to contend in working up the subject index of the "Bibliography of Fishes," and the compilation and publication of Volume III has been delayed for months by the handling of these "left-handed" titles. If such papers were by men of standing, if they were published in reputable journals, if their size indicated that they ought to contain valuable data they were laboriously looked up and properly carded for the index. But if they were short, were published in obscure journals, or were by little known men, they were thrown into "miscellaneous and general," and no further attention was paid to them.

It is really but little short of a crime against science for authors to put at the heads of their articles such faulty and misleading titles. If this is agreed to, then the editors of the journals in which such are published are certainly *participes criminis.* I have talked to a number of scientific men on the subject, but do not recall one who had ever had an editor object to or advise with him as to the wording of his titles. Surely the editors of our scientific journals could and should do all in their power to see to it that the titles of papers which they publish accurately indicate their contents, and thus enable these papers to be quickly and correctly catalogued.

How, then, should a title read so that a bibliographer may correctly classify its contents without having to look the paper up? First, the title should state definitely the subject under consideration—anatomy, embryology, habits, etc. Secondly, it should give both the scientific and the common names of the animal or plant (if it has a common name). The expert in that group of animals will, of course, recognize it by its scientific name, the worker on other animals will place it by its common name. And, thirdly, the group name should if possible be put in. For this the common names, fish, bird, insect, can generally be run in as a matter of course. I recall this title of a fine paper, "On the reactions of [the ghost crab] *Ocypoda arenaria*." The words in brackets were not there and I was entirely at a loss to know what Ocypoda was. With the bracketed words inserted no one could possibly fail to locate at a glance the animal in its group.

Here follow some sample titles the like of which bring peace and not wrath to the troubled souls of bibliographers and librarians. "On the breeding habits and early development of the ganoid fish, *Lepidosteus osseus*." "The structure of the skull in the gaff-topsail catfish, *Felichthys felis*." "The development of the urinogenital system in the bonnet head shark, *Sphyrna tiburo*." "The migrations of the common mackerel, *Scomber scombrus*." "The method of locomotion in the climbing perch, *Anabas scandens*." "The breeding habits of the fighting fish, *Betta pugnax*."

It may not be as easy to make a good title as a bad one, but it can be done. Papers are written that they may be read; hence it will enhance the reputation of the writer if his titles are so clear that the bibliographer and the researcher must as a glance get the contents. And so, out of a hard and heart-breaking experience, as earnestly as I know how I wish to urge authors and editors to write such clear and definite titles as will make for the quick and accurate cataloguing and hence the ready accessibility of their papers. If so done, then by just so much will science be set forward.

E. W. GUDGER

THE AMERICAN MUSEUM OF NATURAL HISTORY

THE RELATION BETWEEN VOLATILITY AND TOXICITY OF NICOTINE

RECENT studies of nicotine as an insecticide have shown that the toxicity curve of nicotine in solutions is almost an exact parallel of its volatility curve. The efficiency of this widely used insecticide may be so lowered by improper methods of handling that the value of the treatment is greatly impaired, or the lowered rate of toxicity is overcome by increasing the dosage used until the expense is almost prohibitive.

Levorotatory nicotine (free nicotine) is volatile and more toxic than the non-volatile dextrorotatory form (nicotine salts). Reduced efficiency then may result from two reasons: (a) the use of non-volatile nicotine salts, such as nicotine sulfate with insufficient alkali to free the alkaloid from the combining acid; (b) the volatilization or oxidation of nicotine from ground tobacco which is being used as a vermifuge.

The loss of nicotine from concentrated solutions of varying alkalinities was determined by evaporation tests with measured amounts of air at a constant temperature and as a dried film on leaf surfaces. The results from these tests were so uniform that only one will be given, namely, the foliage test. The determination of nicotine was made by the silicotungstic acid method. The solutions were all made with distilled water except as noted. The loss of nicotine in three hours was 51.5 per cent. from nicotine sulfate; 85.9 per cent. from free nicotine, and 89.6 per cent. from nicotine sulfate with sufficient alkali to neutralize the combining acid. Comparing these results with solutions made from tap water as in spray practice, we find a loss of 52.5 per cent. and where soap is added, at the rate of four pounds per hundred gallons, the loss was 63.4 per cent. The maximum volatility of nicotine was attained only by the addition of alkali, while in spray practice it is usually assumed that most waters are sufficiently alkaline, especially if soap is used, to free the nicotine and give the maximum efficiency.

Bioassays of dilute nicotine solutions, but with the same alkalinity as above, were made both by spraying and fumigation. The toxicity to aphids (*Aphis hederae* Kalt and *Rhopalosiphum persicae* Sulzer) ranged from 53.6 per cent. for nicotine sulfate in distilled water (pH 6.5) to 76.5 per cent. for nicotine sulfate solution with alkali to neutralize the combining acid (pH 8.2). Nicotine sulfate in tap water plus soap as above (pH 7.6) had an efficiency of 65.3 per cent.

Fumigation tests with those same solutions on aphids showed a range of efficiency from 48.1 per cent. for nicotine sulfate in distilled water (pH 6.5) to 88.4 per cent. for nicotine freed from the combining acid (pH 7.9).

The same correlation between volatility and toxicity was noted in dust mixtures. Kaolin, powdered vegetable matter and sulfur alone gave a very slow release of nicotine. The addition of 10 per cent. of alkali, such as hydrated lime or sodium carbonate, increased the rate of volatility materially, and correspondingly so the degree of toxicity. Sulfur in large proportions aided materially in increasing the efficiency of the dust mixture. The most effective were those containing 80 per cent. or more of sulfur with about 10 per cent. of alkali. Reducing the amount of

sulfur to 40 or 50 per cent. gave a slower release of nicotine and decreased its efficiency.

E. R. DE ONG
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SCIENCE AND INDUSTRY

IN his speech at the annual dinner of the American Philosophical Society, Professor Lawrence J. Henderson congratulated the society upon the fact that it is not allied and almost in partnership with industry and business, but that it adheres to truth for its own sake and feels no need to advertise its wares and thereby cheapen them.

While no true scientists would ever have other than the *very highest respect* for those who pursue truth *simply* for the sake of truth, they will have *at least equal respect* for those who not only pursue truth for its own sake, but who are also keen to apply the results of their researches for the benefit of mankind, whether it be in the fields of medicine, chemistry, physics or other branches.

On the very page (477) whereon is printed Professor Henderson's address is the conclusion of a paper by Dr. A. S. Hitchcock, who states:

> Finally, I believe strongly that scientists as a class should carry their scientific attitude into the realm of affairs outside the world of science.

JEROME ALEXANDER

THE ARGENTINE WEATHER SERVICE

A FEELING of justice to others leads me to call attention to a mistake by Dr. Harvey W. Wiley in SCIENCE of May 9, 1924, p. 423, where he says of Professor Frank H. Bigelow, "He accepted a call from Argentina to organize the weather service of that country."

The weather service of Argentina was organized by Dr. Benjamin Gould in 1872. In 1876 Mr. Walter G. Davis became director and built the service up from small beginnings to one equaling if not excelling in most ways the meteorological organizations of Europe and North America. He retired in 1915 after 39 years of service and the directorship was assumed by George O. Wiggin.

Under Mr. Wiggin the Argentine Service began forecasting the weather from solar data, using more especially the solar heat measurements of the Smithsonian Institution, and now has a solar observatory of its own fully equipped and manned. It thus becomes one of the leaders of the world in this line.

Bigelow was invited to Argentina by Mr. Davis and his work was scientific research and the application of mathematics to meteorology and not administration.

H. H. CLAYTON
CANTON, MASS.
May 28, 1924.

SCIENTIFIC BOOKS

Chronologia Medica. A Handlist of Persons, Periods and Events in the History of Medicine. By SIR D'ARCY POWER and C. J. S. THOMPSON, New York, Paul B. Hoeber, IV, 278 pages, 84 portraits, $3.50.

THE name of Sir D'Arcy Power, one of the most estimable and worthy of living physicians, is a guarantee for the commendable intention of this book. If we venture to point out sundry slips and blunders in its execution, it is in the hope and belief that "corrective action," in the military sense, will make the second edition what it has every right to be, *viz.*, a reliable as well as useful manual for the student, practitioner and medical librarian. The idea of a chronologic panorama of the progress of medicine is not a new one; indeed, from the eighteenth century onward, medical chronologies of varying merit have been prepared and published at intervals by Sprengel, Choulant, Isensee, Pagel, Aschoff and others. In most of these, the contemporaneous happenings in secular and scientific history are printed, flush with each medical item, across two or more folded pages, necessitating a large format. The present arrangement is tandem, making a compact, handy *vade mecum,* confined to medical items alone. As the writers intimate, a medical chronology is but the skeleton or scaffolding of medical history, whence, in order to "clothe the skeleton" and give a "semblance of vitality" to dry lists of dates, many of the items have been set off by explanatory paragraphs. The authors are of opinion that dates help to fix the outstanding events and personalities of medical history in the mind of the student, at the same time reminding us that, in the earlier periods, such dates can be only approximations at best.

The chronology begins with the Assyro-Babylonian God Ea or Oannes (*circa* 5000 B. C.), who heads a list of medical divinities of Mesopotamia, Egypt, India, Persia, Greece and Rome. The chronology, as such, begins to assume practical shape with Greek medicine on page 13. The first thing noticeable in these earlier pages is that not all the gods and physicians listed are of essential importance, so that this part of the work is a bit cluttered up with those "unfamiliar names" which, in the dictum of Coleridge, "are non-conductors, stopping all interest." The unsophisticated student or the hard-worked doctor, looking for "values" in ancient medicine, will derive small consolation from such shadowy meaningless personalities as Esmun, "son of Synyk," Nenekhsekhmel, Wa T'o and Hua T'o, Syennis the Cypriote, Numenios of Herakleia, "who wrote a poem on fishing," or Uranius, "more famous for his conceit than his medical skill." Toward the later periods, the selection of significant names is almost beyond re-

proach, but such names are invariably allocated, in the chronologic scheme, to dates of birth rather than to dates of achievement, with the fortunate exception of physicians of whom only the period in which they flourished is known. The very purpose of the chronology is defeated when we find Vesalius associated with 1514, the date of his birth, instead of 1543, the date of the *Fabrica,* or McDowell thrown into the eighteenth century (1771), when the whole interest of his life centers around his first ovariotomy (1809). We should not, however, quarrel with his arrangement were it possible to make it consistent throughout, but the orderly sequence of dates is frequently dislocated by such unaccountable entries as 1285 (top of page 62) or 1300 (near end of page 63). But it is in the actual spelling of names, notably inconsistencies in the rendering of names of men of similar nationality, that this attractive handbook stands mostly in need of revision. There is, as Victor Hugo said, a definite *"science des noms"* and the correct spelling of these, whether by poet, historian, bibliographer or chronologist, is coeval in importance with the effective use of significant names in verse or scientific prose. To misspell a well-known name renders the culprit liable to the challenge of Milton's Archangel to Satan: "Not to know *me* argues yourself unknown." In this regard the undersigned was once taken to task rather testily by a physiologist who excelled in another speciality, common to us all, namely, the proper spelling of one's own name.

In the chronology before us, such obvious slips as Ellil (p. 3), plague of Antonius (39), Guilelmo (64), Simon de Corco (64), Brunschweig (68), Mark Antonio (69), Heironymus Mercurialis (95), Merchettis (122), Leeuwenhoeck (126), le Blonde (153), Salvatore de Kenyia for S. De Renzi (202), Fiorravanti (263), and Gitolamo (263) may be mercifully charged up to printer's devil or proofreader. But we have in the same book such inconsistencies as Peter of Abano, Petrus ab Argelata and Pietro Andrea Mattioli, Nicholaus the Salernitan and Nicholas Prepositi (55). If it seems advisable to employ such Italianate forms as Salvino degli Armati or Luigi Rolando for Italians, then why such bizarre combinations as Alexander Benedetti (70), François Valleriola (83), Gabriele Falloppius (93), Constantine Varolio (100), Laurence Bellini (131), John Maria Lancisi (137), Andrew Verga (211) and Philip Pacini (212)? On p. 216, Karl Ludwig becomes Charles William Ludwig and the same carelessness is responsible for "Gasper Bauhine" (104), "Johann [Jean] Riolan" (109), "John Laurance Gasser" (157), "Mara Marat" (169) and "Peter Paul Broca" (222). The work terminates with useful chronologies of drugs and of foundations of universities. The list of drugs (245) culminates in two pyramidal absurdities, *viz.,* "d hyoscyaminé d' camphorsulphonate" and "d' hyoscyine hydrobromide."

It may be noted in passing that George Miller Sternberg was in no sense an epidemiologist, nor was Benjamin Franklin a physician, nor Alexander Kovalevsky a morphologist. On p. 30, it is not clear whether Poseidonius or Zopyrus "wrote on the bubonic or true plague." In a compact handbook, such loose statements as the following surely need reconsideration:

> He based his Methodism upon Epicureanism and so combated mysticism [p. 37].
>
> He was one of the fine flowers of the Eastern Empire when the Roman influence in the West was reverting to barbarism [p. 42].
>
> The teaching was considered to be subversive and led to a prolonged controversy [p. 73].

Excellent as are the portraits, it would be no sin of omission to drop out the caricatures of such great men as Pythagoras (14), Aretaeus (32) and Dioscorides (33), and no admirer of William Harvey can credit the atrabilious presentment on page 109. For practical reference purposes, the bothersome unscientific whim of printing pagination figures at the bottom of the page should be discarded in favor of the ordinary labor-saving practise. Nothing is scientific that leads to waste motion or dissipation of energy.

Apart from these defects, the handsome printing and format are what we have come to expect from the publisher (Hoeber), who will add to his reputation for artistic printing and business enterprise, if he will acquire a competent proofreader.

F. H. GARRISON

MANILA, P. I.

LABORATORY APPARATUS AND METHODS

AN APPARATUS FOR THE STUDY OF MICROORGANISMS IN CULTURE SOLUTIONS UNDER CONSTANT HYDROGEN ION CONCENTRATIONS

STUDIES in the changes produced by microorganisms in the hydrogen ion concentration of their culture medium have been made by a number of investigators in many different ways. The general method which has been followed, so far, consists in growing the microorganisms in some culture medium for different lengths of time and observing the changes produced therein. In the majority of cases, such cultures after being examined once were discarded, because of the danger of contamination; although in a few cases they may have been ex-

amined two or more times. The above method serves only in a relatively limited way, because it does not provide sterile conditions for a frequent determination of the changes produced by the microorganisms in their medium, nor for the introduction of adjusting reagents for the maintenance of a constant hydrogen ion concentration. A somewhat different method was employed by Wolf[1] in the study of the changes produced by bacteria in the hydrogen ion concentration of their culture solution. This consists in introducing some indicator, such as are described by Clark and Lubs,[2] and observing the changes produced in the color of the indicator due to the changes in the reaction caused by the organism. This method is not entirely satisfactory, because of the influence of the indicator on the normal development of the microorganisms and the probable decomposition of the indicator, particularly methyl-red, as a result of their reactions.

The writer,[3] while studying the influence of the hydrogen ion concentration on the growth of Fusaria, devised an apparatus by means of which examinations of the changes produced by microorganisms in their culture solutions and introductions of adjusting reagents can be made at frequent intervals and under relatively sterile conditions. This apparatus provides for the removal of any desired portion of the culture solution for examination and the introduction of any volume of adjusting reagent.

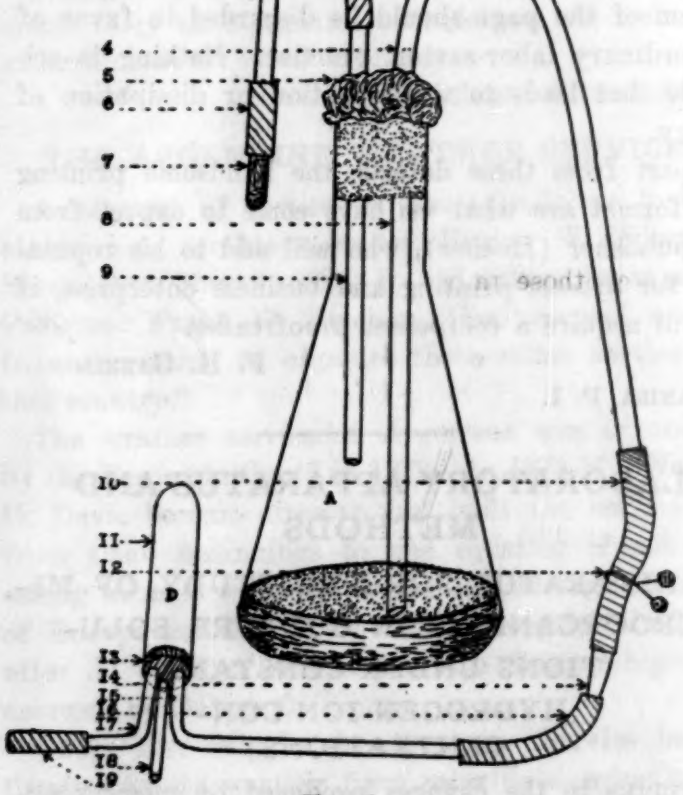

FIG. 1.

The apparatus is very simple in construction and fully illustrated in Fig. I. It consists of an Erlenmeyer's flask (A), carefully plugged with cotton through which are passed two glass-tubes 5 mm in diameter. One of the glass-tubes (B) provides for the introduction of the adjusting reagents and the other (C) for the removal of portions of the culture solution. If desired, two tubes may be provided for the introduction of the adjusting reagents—one for the acids and the other for the alkalies. The other part of the apparatus, which is detachable, is the receiver (D) made out of a test tube (11), plugged with a rubber stopper (13) through which three glass tubes (15), (17) and (18) are passed.

Any desired portion of the solution may be withdrawn from the flask by attaching the one end (16) of the receiver (D) to the nipple (14) of the apparatus and the other end (19) to the suction. Then open pinch cock (12) and close tube (18) by applying the thumb to the opening. When the desired quantity of the solution has been withdrawn tube (C) is raised above the surface of the medium. After all the solution has been drawn into the receiver (D) the pinch cock (12) is closed and the receiver (D) and its attachments are disconnected from the nipple (14).

The adjusting reagents used are placed in flasks which can be made to empty into burettes by means of air pressure generated by a rubber bulb. The opening of the burette through which the discharging glass-tube enters is plugged with cotton in order to prevent contamination from the air. The adjusting reagent to be used must be of such a concentration as to possess disinfectant properties; solutions of 0.2 normal or stronger of either HCl or NaOH may be used with safety. The nipple of the burette in order to be kept sterile is kept immersed constantly in a test tube containing a much stronger solution (about one normal) of the reagent.

Additions of the adjusting reagent may be made to the culture solution by removing the glass rod plug (7) from the rubber tubing (6) and inserting in its place the nipple of the burette which contains the reagent, releasing at the same time the pinch cock (1) to permit the passage of the reagent. The opening of the introduction tube (B) is sealed again

[1] Wolf, F. A., "Studies on the physiology of some plant pathogenic bacteria. VII. Pectic fermentation in culture media containing pectin." *Phytopath.*, Vol. 13, No. 9, Sept., 1923.

[2] Clark, W. M., "The determination of hydrogen ions." Baltimore, 1920, pp. 317.

[3] Sideris, C. P., "The influence of the hydrogen ion concentration on the development of the pink root disease of onions" (in press). Thesis for the Ph.D. degree, Univ. of Calif.

with the glass rod (7), which is dipped in one normal solution of the reagent before insertion.

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A NEW METHOD OF OBTAINING MOSAIC "VIRUS"[1]

IN connection with certain studies on the nature of the causal agent of the mosaic disease it became desirable to secure "virus" with less mixture of foreign substances than could be obtained by filtration of plant extracts through Pasteur or similar filters. It is quite evident that the causal agent of mosaic is carried in the sap of the vascular system of infected plants. By submitting the root system (or the end of a cut stem) to a pressure[2] of about one hundred pounds, it was found that the contents of the vascular bundles could be forced out of the plants and collected with capillary pipettes or medicine droppers. This was accomplished by placing the washed-out roots of the plants in a metal container attached to the city water supply, the stem of the plant extending through a split rubber stopper inserted in a "packing box," similar to that used around valve stems. With a little experience no difficulty was found in making this connection water tight around the plant stem. A succulent mosaic plant with hydathodes readily yields considerable quantities of the liquid water containing the infectious principle, though apparently the "virus" was not as concentrated as when secured from crushed tissue. By cutting the leaf or petioles so as to expose the ends of the bundles the liquid may be secured in a more concentrated form from plants with or without hydathodes. Modifications of the above apparatus and method will be evident to the experimenter to suit the particular needs in hand. It is important to use rapidly growing succulent plants for the best results.

A comparative microscope study of the liquid exuded from healthy and mosaiced plants did not lead to any conclusive results as to the presence of an organism. On slides stained with carbol-fuchsin bodies closely resembling very small bacteria were abundant, but apparently similar bodies occurred in the exudate from healthy plants.

Virus obtained in this way probably closely approximates the virus transmitted by sucking insects, and the method may, therefore, be useful for cross-inoculation studies. This material is also useful in other ways, as, for instance, in attempts at culturing the mosaic agent. The sap as it comes out of the vascular system is usually sterile. It may also prove interesting in studies with other plant diseases, particularly where vascular parasites are concerned.

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[1] Published with the permission of the director of the Wisconsin Agricultural Experiment Station.

[2] This principle was first described by De Bary in studying exudation of liquid water from plants.

SPECIAL ARTICLES

CHROMOSOMAL CHIMERAS IN THE JIMSON WEED

THE production of so-called bud sports is not a rare phenomenon in plants. In general, they may be classified either as sectorial chimeras in which a branch or other portion of the plant shows morphological differences from the rest of the individual, or as periclinal chimeras in which an internal tissue of one type is surrounded by tissue of a different type. The cause of these chimeras has been carefully studied in relatively few cases. Their origin has generally been assumed to be due to somatic mutations in the genes effecting the visible changes. Evidence has been accumulating during the last few years' study of the Jimson Weed (*Datura Stramonium*) that in this species chimeras are brought about by changes in the somatic number of chromosomes, and at least three types of sectorial chromosomal chimeras have been established: (a) those in which one of the sets shows a deficiency of a single chromosome and hence can be represented by the formula $(2n-1)$; (b) those in which the aberrant branch has an extra chromosome, the formula of which would be $(2n+1)$; and (c) those in which one branch has 4n chromosomes or double the number of the normal 2n branch.

(a) *Chimeras with chromosome deficiencies.* In the summer of 1922, two plants from different lines were found each with a branch which showed certain slight deviations from normal. The pollen from both these abnormal branches had considerably more than 50% of abortive grains. Counts of chromosomes in their dividing pollen mother-cells demonstrated a deficiency of one of the largest chromosomes which has been shown to be the extra chromosome present in our $(2n+1)$ mutant known as Rolled. Offspring from these $(2n-1)$ branches failed to show individuals of the parental type, a fact which indicates that gametes deficient for the Rolled chromosome are rarely if ever capable of functioning. In the summer of 1923, a single individual was found with a branch similar in appearance and in the degree of pollen abortion to the two chimeras already mentioned, but the failure of grafts to set prevented a count of its chromosomes. Counts of chromosomes in pollen mother-cells reveal the cytological condition in the subepidermal tissue only and it is possible that these sectorial chimeras were at the same time periclinal chimeras with an epidermal tissue having

a different chromosomal number. That this may have been the case is suggested by the fact that we have found a single plant which was markedly abnormal throughout and distinct from the (2n—1) branches previously investigated, but which was found also to lack one of the same Rolled chromosomes.

(b) *Chimeras with chromosome excess.* A plant otherwise normal, has been found with one branch bearing leaves and capsules which resembled the (2n+1) Globe mutant. Chromosome counts have not yet been secured; but offspring from the normal branches were normal, while offspring from the abnormal branch showed the proportion of Globe seedlings expected from Globe parents. The evidence is clear, therefore, that the subepidermal tissue of the abnormal branch of this chimera was (2n+1) with the extra chromosome in the Globe set. That the epidermal tissue was possibly of a different chromosomal constitution is suggested by the fact that neither the leaves nor capsules on the abnormal branch were fully typical for Globe characters.

(c) *Chimeras with doubled chromosome number.* Several cases have been found chiefly after treatment with cold, in which a single branch on an otherwise normal 2n plant has shown resemblances to a tetraploid. Growth and bud formation in these cases has been poor, but these abnormal branches have been shown to be 4n in generative tissue by the sizes of their pollen grains as well as by the tetraploid offspring which they have produced as contrasted with the 2n offspring produced by the normal branches.

Other and possibly more complicated chimeras which may have a basis in differences in chromosome number are under investigation. The evidence already obtained, however, is sufficient to indicate that chromosomal aberrations may be an important cause in the production of bud sports.

Figures and a more detailed description of the chromosomal chimeras mentioned in the present paper will appear shortly in the *Journal of Heredity*.

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UNIQUE DIETARY NEEDS FOR LACTATION[1]

INVESTIGATION of the dependence of specific bodily functions upon specific nutritive elements is possible because the maintenance of life and, indeed, approximately normal growth are independent of some of those functions. Animals may be reared and will continue to live indefinitely despite disorder, for instance, of the osseous system. It is a matter of practical knowledge centuries old that reproduction may be normal in animals and the function of lactation subnormal or held in abeyance. It has been possible for us to show that active, normal sized and normal appearing rats may be reared by dietary régimes which sterilize them. It has, furthermore, been possible to show that this "dietary" sterility is due to the absence of minute quantities of a specific so-called vitamine substance X, the stability, solubilities and other characteristics of which have now been studied.[2] The commonest dietary régime employed by us in such studies consisted of a well-known mixture of "pure" or isolated foodstuffs (casein 18, cornstarch 54, lard 15, salts 4)[3] together with an abundance of the growth vitamines A and B in the form of butter and yeast. The butter constitutes 9 per cent. of the ration, but the yeast must be fed daily separately in a dose of from 400 to 600 milligrams.

Work with this basal ration of pure food and an abundance of the vitamines at present known should enable us to detect whether or not the function of lactation has other and special dietary dependencies. It is clear that hitherto one could not have amassed the requisite data for such study, since animals do not usually reproduce upon such synthetic mixtures. The detection of the vitamine substance X makes it possible to convey minute but adequate amounts of this substance to animals upon the classic pure food régime and to secure at will reproduction on the régime and to study lactation upon it. Other studies, moreover, have shown that at least one of the foods involved in the pure ration itself, namely, milk fat, possesses seasonally a sufficient contamination with vitamine X to enable animals reared upon this régime to have their first litters. This fact has unfortunately led certain workers to deny the existence of a vitamine which determines reproduction. We have designated this phenomenon "first litter fertility," for upon the same régime the same animals are subsequently sterile. It is due, we believe, to a low amount of dietary vitamine X augmented by

[1] Aided by grants from the National Research Council (Committee for Research on Problems of Sex) and the United States Department of Agriculture (Dairy Division).

[2] Evans and Bishop, SCIENCE, Vol. 56, p. 650, Dec. 8, 1922; *Jour. of Metabolic Research*, Vol. 3, No. 2, Feb., 1923; and Evans and Bishop and Evans and Burr, Proc. Amer. Assoc. Anat., *Anatomical Record*, Vol. 27, No. 4, April, 1924.

[3] Salts. The salt mixture employed was identical with that used by E. V. McCollum and consisted of

NaCl	0.173
$MgSO_4$ (anhyd)	0.266
$NaH_2PO_4 + H_2O$	0.347
$CaH_4(PO_4)_2 + H_2O$	0.540
Fe citrate	0.118
Ca lactate	1.300
K_2HPO_4	0.954

low but constant amounts of X already in the tissues of young animals, since we have proved that the substance is transmitted to them in intrauterine life.

These cases of first litter fertility in animals upon the basal "pure" diet have proved of great value to us in our studies upon lactation. Furthermore, in the cure of sterile animals by the administration of alcoholic or ether extracts of a food substance high in X—wheat germ—it has been possible to study the lactation of animals with induced fertility upon the "pure" régime, modified by the insignificant addition involved in a minute amount (one to six drops) of wheat germ oil daily. About 100 young have been weaned from mothers showing first litter fertility on the basal régime and over 300 have been suckled by mothers likewise on the basal ration but whose fertility was provoked by minute doses of the lipoids found in the embryo of wheat. A singular correspondence obtains in the results secured with both of these large groups. *Lactation is always seriously impaired upon the "pure" diets.* The average weaning weight of the animals resulting from such lactations is almost exactly half that which is normal, *i.e.*, 20 grams instead of 40 grams on the twenty-first day of life. Distribution graphs of the actual weaning weights in the two groups show no overlap (Figures 1 and 2). In practically none of the pure food young is a normal weaning weight secured. Furthermore, the mothers lose approximately five per cent. of their body weight in the performance. *It hence seems to us established that the function of lactation demands for its normal expression either one or more dietary elements different from those adequate for normal growth and for normal reproduction, or else larger quantities of certain dietary elements.*

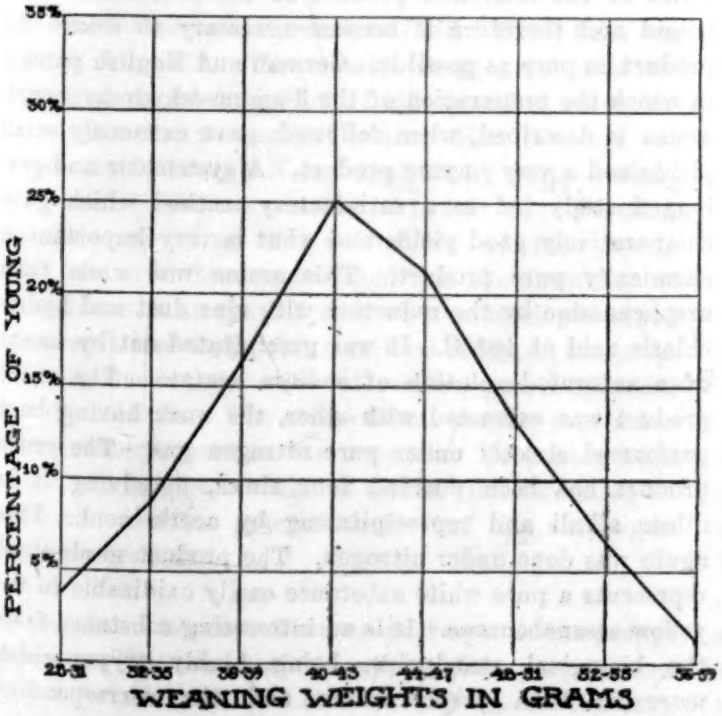

FIG. 1. Distribution of weaning weights (twenty-first day of life) of 503 rats, the mothers of which were on Standard Diet 1 (whole wheat 67, whole milk powder 10, casein 15, NaCl 1, $CaCo_3$ 1.5, milk fat 5).

Striking as are such results, it is conceivable that they are due to the impairment of the young. It may be stated that the new-born of rats on natural foodstuffs are slightly heavier (one gram) and apparently more vigorous than are the pure food nurslings. Some slight abnormality of the young born from "pure food" gestations might be the cause of their inability to grow well during the lactation period. But they grow normally afterwards and a conclusive answer to this contention is furnished, we believe, by a group of exchange experiments which we have instituted. As many as a hundred young from cases of sporadic fertility have now been interchanged with a hundred young from normal mothers upon a generous table scrap diet. The experiment was done in such a way that the normal mother was

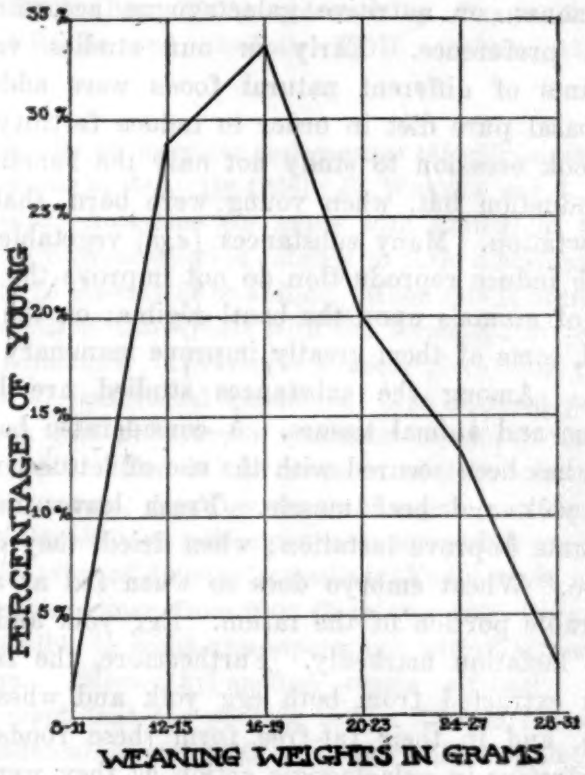

FIG. 2. Distribution of weaning weights of 134 young of mothers on Basal "Pure Food" Diet (casein 18, cornstarch 54, lard 15, milk fat 9, salts 4, yeast daily .5 gram).

forced to accommodate equal numbers of her own and of the synthetic food young, and, conversely, the synthetic food mothers were required to suckle normal young as well as their own. In all cases the litter size was reduced to six. The experiment has shown us that *the young from pure food mothers when suckled by normal mothers possess the same capacity to grow during lactation as do normal animals suckled by their own mothers,* for during the three weeks' lactation period they increase their body weight about seven times. With their

own mothers this increase would have been, roughly, four times. Conversely, normal young suckled by pure food mothers increase their body weight but four times in spite of the somewhat superior vigor with which these animals start life.

Now it is conceivable that the excellent lactatory powers of the normal animals are not actually due to the food consumed by them during the lactation period, but to "reserve" substances in their tissues which can be called upon in this unique need. An answer to this is given by the imperfect lactation resulting when an animal is shifted from a satisfactory diet to the "pure" one. The mammary stimulant must hence be an element of the food.

The natural foods therefore contain a substance, or substances, essential for the normal function of the mammary gland. We have been able to shed some light upon which particular natural foods contain and which do not contain this material, which may be variously termed the lactation auximone, or auximones, or nutritive galactagogue according to one's preference. Early in our studies various amounts of different natural foods were added to the basal pure diet in order to induce fertility, and we took occasion to study not only the function of reproduction but, when young were born, that also of lactation. Many substances (*e.g.*, vegetable oils) which induce reproduction do not improve the lactation of animals upon the basal régime; on the other hand, some of them greatly improve mammary function. Among the substances studied are leaves, grains and animal tissues. A considerable body of data has been secured with the use of lettuce, wheat, egg yolk and beef muscle. Fresh leaves in high amounts improve lactation; when dried, they do not do so. Wheat embryo does so when fed as a considerable portion of the ration. Egg yolk and meat help lactation markedly. Furthermore, the fat has been extracted from both egg yolk and wheat embryo, and in their fat-free form these foods were as effective in galactagogic action as they were formerly. It would appear, therefore, that the food material necessary for normal mammary function is not soluble in fats. Implication of a protein factor is suggested by the potency of meat and grains, even though experiments with milk itself make it seem less likely that either protein or inorganic matter constitutes the dietary substance conditioning normal mammary performance. The total milk solids (we have used as much as a third by weight of the entire ration in the form of whole milk powder) do not repair lactation delinquency so effectually as do the other substances mentioned. Yet the difference between bovine and muridine milk in these very constituents robs such an argument of crucial value. Attention is being paid to the distribution and possible isolation of the food constituent in question. It is by no means ascertained that this is not a well-known substance. A suggestion, however, that this is not the case and that we may be dealing here with one of those specific stimulants to the biochemical mechanism constituted by the so-called auximones like *bios*, is furnished by the superior effect of fresh leaves when contrasted with the same desiccated leaf substance. Be that as it may, a single conclusion—yet an important one—seems clearly validated by the "pure food" lactation studies. Food requirements for normal lactation in the rat are not fulfilled by the classical "synthetic" dietaries of fat, carbohydrate and protein, together with salts and an abundance of the known vitamines A, B, C, D and X—dietaries entirely adequate for growth and reproduction.

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(Continued)

3-amino-4-hydroxyphenylarsine: G. W. RAIZISS and B. C. FISHER. This dihydrochloride of 3, 3′-diamino-4, 4′-dihydroxyarsenobenzene, known under the names of arsphenamine and salvarsan, is a remedy of great value in medicine. Its oxidation product, the 3-amino-4-hydroxyphenylarsineoxide, possesses a still greater destructive effect upon parasites, but it is more toxic and therefore has not been used in treatment of diseases. The authors were interested to study the biological properties of the reduction product of the first-named compound and therefore it became necessary to secure the product as pure as possible. German and English patents in which the preparation of the 3-amino-4-hydroxyphenylarsine is described, when followed, gave extremely small yields and a very impure product. A systematic and prolonged study led to a satisfactory method which gave comparatively good yields and what is very important, a chemically pure product. This arsine was made from arsphenamine by the reduction with zinc dust and hydrochloric acid at 40° C. It was precipitated out by means of a saturated solution of sodium acetate. The crude product was extracted with ether, the work having been performed strictly under pure nitrogen gas. The crude product has been purified four times, dissolving it in dilute alkali and reprecipitating by acetic acid. This again was done under nitrogen. The product so obtained represents a pure white substance easily oxidizable to the yellow arsenobenzene. It is an interesting substance from the biological standpoint, being highly trypanocidal, more so than arsphenamine and the corresponding arsineoxide.

The use of silicon tetrachloride for the synthesis of acid chlorides. (By title): R. E. MONTONNA and H.

HIBBERT. Silicon tetrachloride can be used for the manufacture of acid chlorides from the corresponding acid. In general, one mole of acid was used to one mole of silicon tetrachloride, temperature and operating conditions varying with the acid employed. In most cases it is advisable to dilute the acid with an inert solvent, for example, toluene, xylene, etc. The yields of acetyl-, propionyl-, butyryl-, iso-butyryl-, benzoyl and phenyl acetyl chloride were 85 per cent., 50 per cent., 49 per cent., 53 per cent., 77 per cent., 61 per cent., respectively. It is best to use an iron reaction vessel with suitable agitator, when the residue left consists only of dry silica in a form of powder.

Thermolysis of organic esters: H. HIBBERT and E. M. BILGER. Both organic and inorganic esters decompose on heating, and their behavior is similar in many respects. With organic esters the nature of the decomposition into acid and hydrocarbon varies with the type of ester employed. Ethyl acetate and other esters containing hydrogen atoms attached to the carbon atom in the beta position to the ether oxygen, when heated above a definite temperature limit decompose smoothly into acid and hydrocarbon. Those esters containing no hydrogen atoms in this position are much more stable (methyl acetate, benzyl benzoate, etc.). The mechanism of the reaction may consist of either a straight dissociation (Neff) or intermediate formation of a five-, four- or three-membered ring, and the authors submit certain theoretical speculations as to the mechanism involved in such decompositions.

The application of the diazo reaction in the synthesis of diaryl compounds: M. GOMBERG and W. E. BACHMANN. About 20 compounds of this nature are described, which have been prepared in this manner and the constitution of which has been definitely determined.

New researches on the proteins of silk: E. M. SHELTON and T. B. JOHNSON. The research in progress is a continuation of an investigation of silk proteins which has been in operation for several years. New evidence has been presented through X-ray analysis by other workers that fibroin of silk is a mixture of two or more proteins. Conclusions regarding the uniformity of the protein sericine has never been established and the chemistry of this substance is at present in a very undeveloped state. This research has dealt with a critical study of the properties and chemical behavior of sericine prepared under different conditions. The action of the enzyme pepsin has also been incorporated in the research. Data have been obtained which have revealed a clearer understanding of the behavior and the practical utility of this enzyme as a degumming agent.

Dissociation and reversible rearrangement of the propyl bromides by heat, and their formation from propene and hydrogen bromide: R. F. BRUNEL and H. G. RAFSKY. Heating of either normal or isopropyl bromide in the gas state gives an equilibrium mixture of the two bromides with their dissociation products, hydropropyl bromide and propene. The ratio of iso- to normal propyl bromide at 300° is 73:27. The degree of dissociation of these bromides does not differ greatly from that of the butyl bromides previously investigated. The action of hydrogen bromide on propene gives mixtures running all the way from nearly pure n-propyl to nearly pure isopropyl bromide.

Evidence of the symmetrical constitution of the dihalogen substitution products of acetylene: L. B. HOWELL. In studying the reactions of C_2Cl_2, striking evidence against the existence of so-called acetylidine structure, *i.e.*, $Cl_2C{:}\,C{:}$ (Nef, Ann., 298, 345, 361; 308, 325) is found. When dichloro-acetylene adds a mole of iodine it should, according to Nef's theory, give $Cl_2C{:}\,CI_2$ identical with the chlorination product of C_2I_2. Iodination of C_2Cl_2 has been carried out, and it is found to yield a $C_2Cl_2I_2$ (w. solid, m. p. 67.5°–8.5°) different from the liquid isomer (m. p. 2.5°–3°, b. p. 243°) obtained from C_2I_2 and chlorine in previous work. These dichloro-diiodo-ethylenes are evidently the cis and trans stereomers. $ClIC = CClI$. Similar evidence is found in the fact that C_2Cl_2 upon bromination gives the symmetrical $ClBrC{:}\,CBrCl$ (b. p. 172°) obtained by Swarts from $CClBr_2 \cdot CHClBr$ and alcoholic KOH. (Cent., 1889, 1, 588.)

The behavior of acetylene and cuprous chloride catalyst in an ammonia system (By title): H. WENZKE and J. A. NIEUWLAND. Acetylene condenses with aniline in the presence of cuprous chloride catalyst to form a substance thought to be bis-ethylidine aniline. When this is heated, a rearrangement takes place with the formation of substituted quinolines. The reaction takes place with the formation of substituted quinolines. The reaction proceeds much like a Skraup's synthesis, especially when nitrobenzene is added in the presence of HCl solution. Efforts to prepare, or rather separate a pure compound from quinaldines have not as yet been successful, except the identification of β-methyl-quinoline. The mixture has a boiling point range from 200° C. to over 300° C., and it is impossible to make any separations with fractional distillation. Mono-ethyl-analine reacts similarly to aniline, except that the product is less fluid in nature. In the condensation with CuCl as a catalyst, the optimum concentration of the catalyst was 6 per cent. to 7 per cent. of the weight of the reacting mixture. Benzylamine, dimethylaniline and diphenylamine were also tried.

The reaction of bromo-nitro-methane with aromatic compounds in the presence of aluminium chloride: M. L. SHERRILL. An investigation of the reaction of bromo-nitro-methane upon the following aromatic compounds has been made: benzene, mono-bromo-benzene, mono-chloro-benzene and anisol. In every case that has been studied, the isolation of two types of products indicates the main trend of the reaction. The one type is either the aromatic nitro-methane, or the corresponding aromatic aldehyde or acid, the latter two compounds formed by the decomposition of the aromatic nitro-methane; the other type is the brominated aromatic compound. The yields of the former type of product have been from 10 to 45

per cent. of the theoretical, while those of the brominated compounds have been from 25 to 65 per cent.

The preparation of thioacetic acid: H. T. CLARKE and W. W. HARTMAN. Hydrogen sulfide does not react with either acetic anhydride or acetyl chloride alone, but readily converts acetic anhydride into a mixture of acetic acid and thioacetic acid in the presence of a small proportion of acetyl chloride. Hydrogen chloride, sulfuric acid and acetyl bromide act in the same way, the last being a particularly efficient catalyst. The resulting thioacetic acid and acetic acid may readily be separated by fractional distillation.

Hydroxamic acids of hydroxy and alkoxy fatty acids: D. H. POWERS and L. JONES. Glycolic ethyl ester reacts with hydroxylamine in alcohol solution to give glycolhydroxamic acid, m. p. 85°, from which were prepared the benzoyl and acetyl derivatives and their salts. The rearrangement of these salts in alcohol solution does not give the expected urethanes, but allophanic ester: a product which may be explained by the formation of cyanic acid in the course of the rearrangement. Methoxyacethydroxamic acid and ethoxyacethydroxamic acid were prepared from the ester and acid chloride, and their derivatives prepared and studied. Rearrangement of their salts does not give the amines of urea derivatives expected, but their decomposition products: carbon dioxide, ammonia, formaldehyde and methyl or ethyl alcohol. Attempts to prepare these amines by other methods invariably gave the same decomposition products. Methoxymethyl isocyanate, b. p. 87°, and ethoxymethyl isocyanate, b. p. 106°, were prepared from silver cyanate and the corresponding monochlor ethers. In the presence of moisture, they were hydrolyzed to carbon dioxide, ammonia, formaldehyde and methyl and ethyl alcohol, respectively.

Action of the hypochlorous acid on alcohols: M. C. TAYLOR, R. B. MACMULLIN and C. A. GAMMAL. It has been shown that the action of HOCl on monohydric alcohols to form esters is a general reaction. Determinations of molecular weight of ethyl hypochlorite based on alcohol and chlorine content and on vapor density agree in showing that this compound is an ester and not a double compound similar to those described by Kendall. Comparatively stable solvent solutions of these esters may be readily prepared by shaking HOCl, made by chlorinating a limestone suspension, with alcohol and a solvent immiscible with water. The reaction proceeds to equilibrium so rapidly and uniformly that the distribution of the available chlorine between the water and solvent layer can be used as a means of estimating accurately the amount of alcohol present. A physical chemical study of the action of HOCl on ethyl alcohol in the presence of CCl_4 has been made including the following points: (a) Equilibrium constant of the reaction HOCl — EtOh — EtOCl — H_2O. (b) Distribution ratio of EtOCl between CCl_4 and water. (c) Effect of temperature on rate of reaction. It has been found that these solvent solutions can be made to react with hydrated lime and water to form solid calcium hypochlorite which can be filtered off.

Hyponitrites: A. W. SCOTT and L. W. JONES. Sodium hyponitrite was prepared by the action of ethyl nitrite on free hydroxylamine. Since the alkali hyponitrites are most stable in an alkaline solution, methanol containing sodium methylate was employed as the reaction medium. Sodium hyponitrite was obtained in a yield of 13½ per cent. and in a state of comparative purity. Silver hyponitrite was made by the addition of an aqueous solution of silver nitrite to a neutral aqueous solution of sodium hyponitrite. The yield was practically quantitative.

A contribution to the chemistry of pyruvic ureide: D. DAVIDSON and T. B. JOHNSON. The name pyruvic ureide indicates a product of reaction formed by condensation of pyruvic acid with urea. It is represented structurally in chemical literature as a monomolecular compound containing free methylene group as illustrated by formula I. Gabriel has assigned the constitutional formula II to this compound. New evidence has been obtained indicating that the formula given by Gabriel is correct.

$$\underline{NH \cdot CO \cdot NHCO \cdot C : CH_2}$$

I

$$\underline{NHCONHCOC : CH \cdot C(CH_3) \cdot CO \cdot NH \cdot CONH}$$

II

The research has also involved the study of the nitro derivatives of pyruvic ureide III, particularly its behavior on reduction. It has been found that this substance behaves in a manner analogous to nitrostyrene and is reduced in the presence of platinum to the oxime of hydantoin aldehyde IV.

$$\underline{NH \cdot CO \cdot NH \cdot CO \cdot C : CHNO_2} \quad \text{to}$$

III

$$\underline{NHCONHCO \cdot CH \cdot CH : NOH}$$

IV

Preparation and hydrolysis of di-n-butylcyanamide and diallylcyanamide: E. B. VLIET. A method was desired by which di-n-butylamine and diallylamine could be prepared in relatively pure form, free from primary and tertiary amines. The hydrolysis of the corresponding cyanamides, using dilute sulfuric acid, furnished a very satisfactory method.

$$R_2NCN + 2H_2O = R_2NH + NH_3 + CO_2.$$

Di-n-butylcyanamide and diallylcyanamide were prepared by first obtaining a solution of sodium cyanamide by the action of sodium hydroxide on a suspension of lime nitrogen in water. This, upon addition of alcohol, readily reacts with butyl and allyl bromides to form the desired products.

J. A. NIEUWLAND,
Secretary

(To be continued)